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Mr. Scott Black  
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Subject: Department of Natural Resources Washington Geological Survey,  
School Seismic Safety Assessment Project, Contract No. AE 410 -  
Seismic Evaluation for **Vashon Island School District**

Dear Ms. Forson and Mr. Black:

Reid Middleton and our consultant team, under the direction of The Department of Natural Resources (DNR) Washington Geological Survey (WGS) School Seismic Safety Project, have conducted seismic evaluations of 222 school buildings and 5 fire stations throughout Washington State. This letter is transmitting the results of these seismic assessments for each school district that graciously participated in this statewide study. We understand that you will be forwarding this letter and the accompanying seismic screening reports to each school district for their reference and use.

Many disparate studies on improving the seismic safety of our public school buildings have been performed over the last several decades. Experts in building safety, geologic hazards, emergency management, education, and even the news media have been asserting for decades that seismic risks in older public school buildings represent a risk to our communities. The time to act is now, before we have a damaging earthquake and/or tsunami that could be catastrophic. This statewide school seismic safety assessment project provides a unique opportunity to draw attention to the need for statewide seismic safety policies and funding on behalf of all school districts that will help enable school districts to increase the seismic safety of their older buildings to make them safer for students, teachers, staff, parents, and the community.

It is not the intent of this study to create an unfunded mandate for school districts to seismically upgrade their schools without associated funding or statewide seismic safety policy support. The overall goal of this study was to screen and evaluate the current levels of seismic vulnerabilities of a statewide selection of our older public school buildings and to use the data and information to help quantify funding and policy needs to improve the seismic safety of our public schools. In this process, we are using the information to inform not only the Governor

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and the Legislature of the policy and funding needs for seismically safe schools but also the school districts that participated in the study.

### **School Buildings Evaluated in the Vashon Island School District**

We appreciate Vashon Island School District's participation and invaluable assistance in this statewide project. The following school district buildings were included as part of this study:

1. Vashon Island High School, Building D – Gymnasium
2. Vashon Island High School, Building K – Annex

The seismic screening of these buildings was performed using the American Society of Civil Engineers' Standard 41-17, *Seismic Evaluation and Retrofit of Existing Buildings* (ASCE 41-17), national standard Tier 1 structural and nonstructural seismic screening checklists specific to each building's structure type.

The WGS also conducted seismic site class assessments to measure the shear wave velocity and determine the soil site class at each campus. Site class is an approximation of how much soils at a site will amplify earthquake-induced ground motions and is a critical parameter used in seismic design. Reid Middleton subsequently used this information in their seismic screening analyses.

The following table is a list of available seismic assessment information used in our study:

<b>School Building</b>	<b>Year Constructed</b>	<b>FEMA Building Classification</b>	<b>Drawings Available for Review</b>
Vashon Island High School, Building D – Gymnasium	1961	Reinforced Masonry Walls with Flexible Diaphragms	Some
Vashon Island High School, Building K – Annex	1957	Wood Frame	No

Detailed descriptions of the seismic screening evaluations of these buildings can be found in the individual building reports and the ASCE 41-17 Tier 1 screening checklist documents enclosed with this letter. This information will also be available for download on the WGS website: <https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/earthquakes-and-faults/school-seismic-safety>.

These Tier 1 seismic screening checklists are often the first step employed by structural engineers when trying to determine the seismic vulnerabilities of existing buildings and to begin a process of mitigating these seismic vulnerabilities. School district facilities management personnel and their design consultants should be able to take advantage of this information to help inform and address seismic risks in existing or future renovation, repair, or modernization projects.

It is important to note that information used for these school seismic screenings was limited to available construction drawings and limited site observations by our team of licensed structural engineers to observe the general conditions and configuration of each building being seismically screened. In many cases, construction drawings were not available for review as noted in the table above. Due to the limited scope of the study, our team of engineers were not able to perform more-detailed investigations above ceilings, behind wall finishes, in confined spaces, or in other areas obstructed from view. Where building component seismic adequacy was unknown due to lack of available information, the unknown conditions were indicated as such on the ASCE 41-17 Tier 1 checklists. Additional field investigations are recommended for the “unknown” seismic evaluation checklist items if more-definitive determinations of seismic safety compliance and further development of seismic mitigation strategies are desired.

### **Nonstructural Seismic Screening**

The enclosed ASCE 41-17 Tier 1 Nonstructural Seismic Screening checklists can provide immediate guidance on seismic deficiencies in nonstructural elements. Mitigating the risk of earthquake impacts from these nonstructural elements should be addressed as soon as practical by school districts. Some nonstructural elements may be easily mitigated by installing seismic bracing of tall cabinets, moving heavy contents to the bottom of shelving, and adding seismic strapping or bracing to water tanks and overhead elements (light fixtures, mechanical units, piping, fire protection systems, etc.).

It is often most economical to mitigate nonstructural seismic hazards when the building is already undergoing mechanical, electrical, plumbing, or architectural upgrades or modernizations. Enclosed with these nonstructural seismic screening checklists are excerpts from the Federal Emergency Management Agency (FEMA) publication E-74 entitled, *Reducing the Risks of Nonstructural Earthquake Damage* (FEMA E-74). We have included these FEMA publication excerpts to help illustrate typical seismic mitigation measures that can potentially be implemented by district facilities and maintenance personnel.

### **Structural Seismic Screening**

The enclosed ASCE 41-17 Tier 1 Structural Seismic Screening checklists have evaluation statements that are reviewed for specific building elements and systems to determine if these items are seismically compliant, noncompliant, not applicable, or unknown. These evaluation statements provide guidance on which structural systems and elements have identified seismic deficiencies and should be investigated further. Further seismic evaluations beyond these seismic screening checklists typically consist of more-detailed seismic structural analyses to better define the seismic vulnerabilities and risks. This information is then used to determine cost-effective ways to seismically improve these buildings with stand-alone seismic upgrade projects or incrementally as part of other ongoing building maintenance, repair, or modernization projects. Consequently, implementing seismic structural mitigation strategies

typically requires that they be developed as a part of longer-term capital improvements and modernization programs developed by the school district and their design consultants.

### Next Steps

Due to the screening nature of the ASCE 41-17 Tier 1 procedures, an in-depth seismic evaluation and analysis of these buildings may be needed before detailed seismic upgrades or improvements, conceptual designs, and probable construction cost estimates are developed.

If you have any questions or comments regarding the engineering reports or would like to discuss this further, please contact us.

Sincerely,



David B. Swanson, P.E., S.E.  
Principal, LEED AP, F.SEI



### Limitations

The professional services described in this document were performed based on available information and limited visual observation of the structures. No other warranty is made as to the professional advice included in this document. This document has been prepared for the exclusive use of the Department of Natural Resources, the Office of the Superintendent of Public Instruction, and this school district and is not intended for use by other parties, as it may not contain sufficient information for other parties' purposes or their uses.

# 1. Vashon Island, Vashon Island High School, Building D - Gymnasium

## 1.1 Building Description

Building Name:	Building D - Gymnasium
Facility Name:	Vashon Island High School
District Name:	Vashon Island
ICOS Latitude:	47.423
ICOS Longitude:	-122.457
ICOS	
County/District ID:	17402
ICOS Building ID:	20350
ASCE 41 Bldg Type:	RM1
Enrollment:	596
Gross Sq. Ft. :	23,744
Year Built:	1961
Number of Stories:	3
S <sub>XS</sub> BSE-2E:	1.049
S <sub>X1</sub> BSE-2E:	0.565
ASCE 41 Level of Seismicity:	High
Site Class:	C
V <sub>S30</sub> (m/s):	375
Liquefaction Potential:	very low
Tsunami Risk:	Extremely Low
Structural Drawings Available:	some
Evaluating Firm:	BergerABAM/WSP



The Vashon HS Gym and associated spaces are constructed from reinforced masonry with brick veneer. The roof framing is wood. The on grade floors are 5 inch reinforced concrete slab on grade. The floors above grade (first floor boys locker room and upper gym) are reinforced concrete floor joists with integral concrete beams supported by precast concrete columns. The locker rooms and upper gym are stacked, forming a three-story space. The bearing/shear walls are supported on continuous footings. The structural floors are supported on concrete columns and cmu bearing walls. The gym is roughly 100 ft x 100 ft and the stacked locker rooms/upper gym space is roughly 100 ft x 37 ft. The one-story classroom/foyer space is 44 ft x 59 ft.

### 1.1.1 Building Use

The gym building (Bldg D) includes the main gym, locker rooms for girls (lower level) and boys (main level), an upper gym and an adjacent one-story foyer and classroom space. The gym is constructed on a sloping site so the three story portion takes advantage of the grade change (reference photo of east wall).

### 1.1.2 Structural System

**Table 1.1-1. Structural System Description of Vashon Island High School**

Structural System	Description
Structural Roof	The structural roof consists of large (12-1/4" wide) glulam beams at 16'-8" on center with 2x6 tongue and groove diagonal decking. The structural roof at the one-story classroom/foyer space is 7" wide glulam beams at 9'-10" oc and 3" tongue and groove decking perpendicular to the beams.
Structural Floor(s)	The gym, girls locker room, and classroom/foyer floors are 5" thick slab on grade reinforced with 6x6 10/10 welded wire mesh. The boys locker room floor (level with gym floor) and the upper gym activities area are reinforced concrete floor joists with integral concrete beams.
Foundations	Foundations consist of continuous footings under the exterior walls and the retaining walls (girls locker room at grade change) and spread footings under the precast concrete columns and the gym pilasters.
Gravity System	The gravity framing system consists of a wood frame roof and reinforced concrete floor joist/beams at elevated floors. Walls consist of reinforced masonry walls at gym and reinforced concrete retaining walls at the grade change.
Lateral System	The lateral force resisting system consists of a wood frame roof diaphragm, concrete diaphragms at the mezzanine space with reinforced masonry and reinforced concrete shear walls.

### 1.1.3 Structural System Visual Condition

**Table 1.1-2. Structural System Condition Description of Vashon Island High School**

Structural System	Description
Structural Roof	Did not observe signs of corrosion, damage or deterioration.
Structural Floor(s)	Did not observe signs of corrosion, damage or deterioration.
Foundations	Unknown
Gravity System	Did not observe signs of corrosion, damage or deterioration.
Lateral System	Did not observe signs of corrosion, damage or deterioration.

## 1.2 Seismic Evaluation Findings

### 1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

**Table 1-3. Identified Structural Seismic Deficiencies for Vashon Island Vashon Island High School Building D - Gymnasium**

Deficiency	Description
Mezzanines	Details at the upper gym floor (wrestling) to the supporting masonry wall are not indicated on the structural drawings but are included on the existing architectural drawings. Appears to be a bearing detail (pocketed into wall) without a direct tie between the wall and the floor diaphragm.
Reinforcing Steel	Steel reinforcement ratio does not meet requirements. Vertical plus horizontal reinforcement ratio equals 0.0015 which is less than required ratio of 0.002. Vert reinforcement ratio is 0.0004 (#3 at 4 ft oc) which is less than required 0.0007 ratio. Measures such as adding shotcrete at wall may be required. Requires further investigation. Vertical reinforcement does extend to top of wall.
Wall Anchorage	Details on the existing drawings do not indicate dowels between the upper gym (wrestling) space and the masonry walls. The tie between the masonry walls and the roof diaphragm is unclear on the existing drawings. Further investigation required.
Transfer to Shear Walls	Existing drawings do not indicate load path between roof diaphragm and masonry shear walls. Further field investigation recommended.
Cross Ties	Existing drawings do not indicate cross ties between the roof diaphragm chords. Added straps likely required. Further investigation recommended.
Diagonally Sheathed and Unblocked Diaphragms	Main Gym roof is roughly 100 ft x 100 ft with no interior shear resistance lines. Additional sheathing may be required at roof diaphragm.

### 1.2.2 Structural Checklist Items Marked as 'Unknown'

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

**Table 1-4. Identified Structural Checklist Items Marked as Unknown for Vashon Island Vashon Island High School Building D - Gymnasium**

Unknown Item	Description
Torsion	The earthquake forces from the upper gym (wrestling) are distributed to the three perimeter walls as the fourth wall is shown on the existing drawings as open to the gym below. This wall has been infilled at some point but is not a shear wall. The three-sided configuration of the shear walls layout will induce torsion, however the perimeter walls will resist both the direct shear as well as the torsional shear. The stair openings at each end interrupt the shear transfer and torsion should be further studied.
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The site is a sloping site with a grade change equal to a story. Earthquake-induced slope failures or rockfalls may be an issue. Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Wood Ledgers	The tie between the masonry walls and the roof diaphragm is unclear on the existing drawings.
Openings at Exterior Masonry Shear Walls	The second floor stair openings adjacent to the shear walls are greater than 8 feet long in the east-west direction. Considering the overall wall length of 133 feet, the 10 ft. 9 in. opening is not expected to be a problem.
Spans	The gym roof is diagonal sheathed. The classroom wing is not and has a span greater than 24 ft.
Stiffness of Wall Anchors	Existing drawings did not indicate anchorage, further investigation recommended.



1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-5. Identified Nonstructural Seismic Deficiencies for Vashon Island Vashon Island High School Building D - Gymnasium

Deficiency	Description
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The Tier 1 nonstructural seismic evaluation performed for this school building could not confirm nonstructural seismic deficiencies due to limited access for visual observation and/or lack of existing drawings available for review. Please refer to the next page of this report for the list of nonstructural items marked as “unknown” and commentary indicating the need for further investigation or the likelihood of compliance or non-compliance based on the age of construction.

### 1.3.2 Nonstructural Checklist Items Marked as 'Unknown'

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

**Table 1-6. Identified Nonstructural Checklist Items Marked as Unknown for Vashon Island Vashon Island High School Building D - Gymnasium**

Unknown Item	Description
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings (dated 1961) or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings (dated 1961) or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings (dated 1961) or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	No seismic joints.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Not detailed on drawings. Did not enter classroom wing but none of the other spaces had panelized ceilings.
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Did not observe equipment containing hazardous materials mounted on vibration isolators. District to confirm.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Did not observe breakable containers with hazardous materials. District to confirm.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Did not observe piping or ductwork conveying hazardous materials. District to confirm.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Did not observe but most likely compliant. District to confirm.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Did not observe flexible couplings. District to confirm.
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Limited details available on existing drawings. Unclear if partitions are reinforced (an example is detail 7/A7). Investigate further.
P-3 Drift. HR-not required; LS-MH; PR-MH.	No details available.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Did not enter classroom wing. Gym building did not have suspended ceilings.
CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	According to existing drawings, obscure wire glass is provided at clerestory windows.

Unknown Item	Description
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Expected that veneer is anchored to the backup at weakened planes since veneer anchorage is indicated on the existing drawings.
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	The condition at floors and roof is not specifically detailed on the existing drawings, but general veneer anchorage is indicated.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Existing drawings do not indicate how masonry stack is anchored at the first and second floors.
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Did not observe racks more than 12 ft high. District to confirm. See Report documents (including Appendix) for bracing guidance.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Did not observe, district to confirm. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint. See Report documents (including Appendix) for bracing guidance.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Did not observe, district to confirm. Heavy items on upper shelves should be restrained by netting or cabling to avoid becoming falling hazards. See Report documents (including Appendix) for bracing guidance.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Some equipment in the mechanical rooms did not appear to be braced. This should be further evaluated. See Report documents (including Appendix) for bracing guidance.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Unclear if in-line equipment was braced as required. This should be further evaluated. See Report documents (including Appendix) for bracing guidance.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Did not observe that any of the equipment falls into this category, but this should be confirmed. Brace tops of tall narrow equipment taller than 6 feet to nearest backing wall, provide overturning base restraint. See Report documents (including Appendix) for bracing guidance.

Photos:



**Figure 1-1. Vashon HS Gym South wall**



Figure 1-2. Vashon HS Gym West wall





**Figure 1-3. Vashon HS Gym East wall (three-story)**



**Figure 1-4. Vashon HS North Gym wall**



Figure 1-5. Overhead AHU



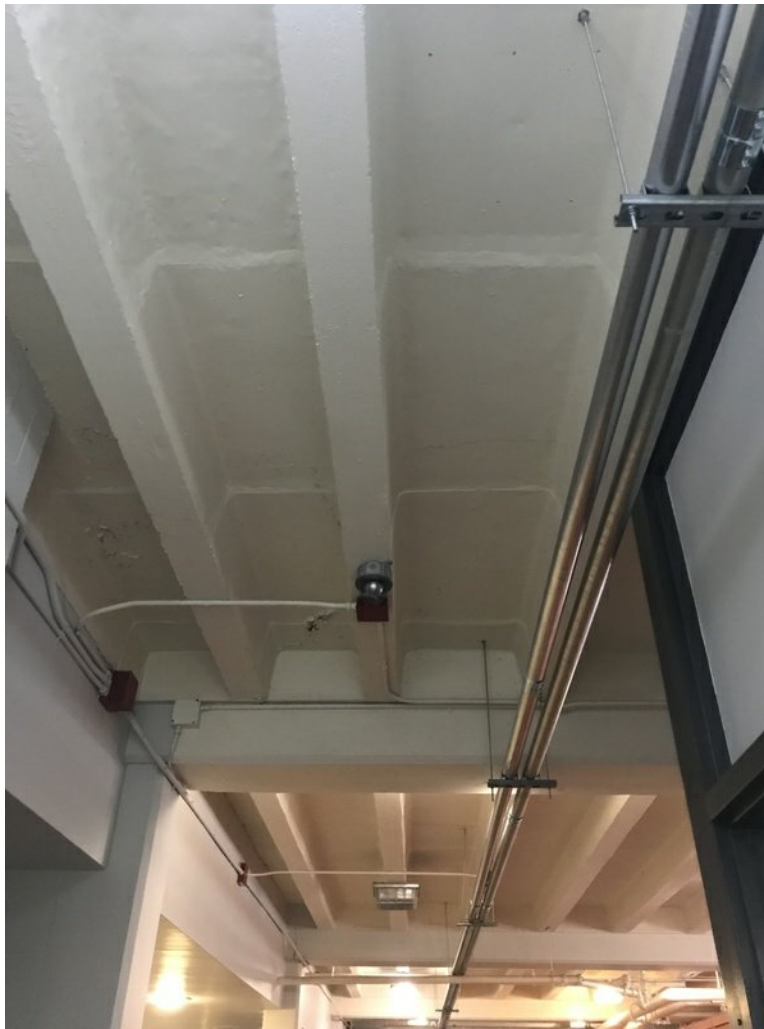
Figure 1-6. Gym roof with wood beams, 4x10 purlins and diagonal shiplap sheathing





Figure 1-7. Clerestory with windows and louvers





**Figure 1-8. Main floor framing (concrete floor joists and beams)**



Figure 1-9. Mechanical room



Figure 1-10. Recent HVAC upgrade with bracing

## Vashon Island, Vashon Island High School, Building D - Gymnasium

### 17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

#### Low Seismicity

##### Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)	X				Limited drawings dated 1961 were available.
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	X				No adjacent building.
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)				X	Details at the upper gym floor (wrestling) to the supporting masonry wall are not indicated on the structural drawings but are included on the existing architectural drawings. Appears to be a bearing detail (pocketed into wall) without a direct tie between the wall and the floor diaphragm.

##### Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Weak Story	The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)	X				While the site slopes and the building configuration is a combination of a three-story stack, a tall one-story gym and a short one-story classroom/foyer, the lateral force resisting system is well distributed and stacked where applicable. The weak story classification does not apply.
Soft Story	The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)	X				While the site slopes and the building configuration is a combination of a three-story stack, a tall one-story gym and a short one-story classroom/foyer, the lateral force resisting system is well distributed and stacked where applicable. The soft story classification does not apply.
Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)	X				The masonry shear walls are stacked, well distributed and continuous to the foundations.
Geometry	There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)	X				The masonry shear walls are stacked, well distributed and continuous to the foundations.
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)	X				While the site slopes and the building configuration is a combination of a three-story stack, a tall one-story gym and a short one-story classroom/foyer, the mass is distributed via tributary area to the adjacent shear walls. Concerns about a change in effective mass do not apply.

Torsion	The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)				X	The earthquake forces from the upper gym (wrestling) are distributed to the three perimeter walls as the fourth wall is shown on the existing drawings as open to the gym below. This wall has been infilled at some point but is not a shear wall. The three-sided configuration of the shear walls layout will induce torsion, however the perimeter walls will resist both the direct shear as well as the torsional shear. The stair openings at each end interrupt the shear transfer and torsion should be further studied.
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### **Moderate Seismicity** (Complete the Following Items in Addition to the Items for Low Seismicity)

#### **Geologic Site Hazards**

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)				X	The site is a sloping site with a grade change equal to a story. Earthquake-induced slope failures or rockfalls may be an issue. Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.

Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
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## High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

### Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)	X				$0.6S_a = 1.049$ which is much less than the base/height ratio of 5.
Ties Between Foundation Elements	The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)	X				Footings restrained by slab on grade. Site Class C soils.

## 17-34 Collapse Prevention Structural Checklist for Building Types RM1 and RM2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

### Low and Moderate Seismicity

#### Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				Masonry shear walls are well distributed at the perimeter.
Shear Stress Check	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.2 (0.48 MPa). (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.4.1)	X				Per the ASCE Quick Check procedure, the shear stress check is compliant. It should be noted that the existing 6-inch masonry walls are reinforced with #3 verts at 48 inches oc per existing drawings. This does not meet current code.
Reinforcing Steel	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in. (1220 mm), and all vertical bars extend to the top of the walls. (Tier 2: Sec. 5.5.3.1.3; Commentary: Sec. A.3.2.4.2)		X			Steel reinforcement ratio does not meet requirements. Vertical plus horizontal reinforcement ratio equals 0.0015 which is less than required ratio of 0.002. Vert reinforcement ratio is 0.0004 (#3 at 4 ft oc) which is less than required 0.0007 ratio. Measures such as adding shotcrete at wall may be required. Requires further investigation. Vertical reinforcement does extend to top of wall.

#### Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Topping Slab	Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Tier 2: Sec. 5.6.4; Commentary: Sec. A.4.5.1)			X		No precast concrete diaphragm elements. No structural concrete topping slab.

#### Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Wall Anchorage	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Tier 2: Sec. 5.7.1.1; Commentary: Sec. A.5.1.1)		X			Details on the existing drawings do not indicate dowels between the upper gym (wrestling) space and the masonry walls. The tie between the masonry walls and the roof diaphragm is unclear on the existing drawings. Further investigation required.
Wood Ledgers	The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 5.7.1.3; Commentary: Sec. A.5.1.2)				X	The tie between the masonry walls and the roof diaphragm is unclear on the existing drawings.
Transfer to Shear Walls	Diaphragms are connected for transfer of seismic forces to the shear walls. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)		X			Existing drawings do not indicate load path between roof diaphragm and masonry shear walls. Further field investigation recommended.
Topping Slab to Walls or Frames	Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.)				X	No precast concrete diaphragm elements. No structural concrete topping slab.
Foundation Dowels	Wall reinforcement is doweled into the foundation. (Tier 2: Sec. 5.7.3.4; Commentary: Sec. A.5.3.5)	X				Footing dowels indicated on the existing architectural wall sections and in the general structural notes.
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)	X				Existing structural drawings indicate positive connection between the roof beams and the supporting columns. (Reference details 3/S-4 and 5A/S-4).

## High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

### Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)	X				The second floor stair openings adjacent to the shear walls are much less than 25% of the wall length.



Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)				X	The second floor stair openings adjacent to the shear walls are greater than 8 feet long in the east-west direction. Considering the overall wall length of 133 feet, the 10 ft. 9 in. opening is not expected to be a problem.
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### Flexible Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Cross Ties	There are continuous cross ties between diaphragm chords. (Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2)		X			Existing drawings do not indicate cross ties between the roof diaphragm chords. Added straps likely required. Further investigation recommended.
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)	X				No openings at the flexible roof diaphragm.
Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)	X				No openings at the flexible roof diaphragm.
Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)			X		The classroom wing roof diaphragm is straight-sheathed with an aspect ratio less than 2 to 1 in each direction.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)				X	The gym roof is diagonal sheathed. The classroom wing is not and has a span greater than 24 ft.
Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4 to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)		X			Main Gym roof is roughly 100 ft x 100 ft with no interior shear resistance lines. Additional sheathing may be required at roof diaphragm.
Other Diaphragms	Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				All diaphragms are either wood (decking) or concrete.

### Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Stiffness of Wall Anchors	Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. (3 mm) before engagement of the anchors. (Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)				X	Existing drawings did not indicate anchorage, further investigation recommended.
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# Vashon Island, Vashon Island High School, Building D - Gymnasium

## 17-38 Nonstructural Checklist

Notes:

C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

Level of Seismicity: L = Low, M = Moderate, and H = High

### Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on year of construction (1961) of the building, it is assumed that seismic bracing for fire suppression piping does not comply with NFPA 13. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on age of the building, it is assumed the flexible couplings on the fire suppression piping do not comply with NFPA 13. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.

LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		No enclosed stairs.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)				X	Not detailed on drawings. Did not enter classroom wing but none of the other spaces had panelized ceilings. Further investigation may be appropriate to mitigate seismic risk.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		Not required for Life Safety Performance Level

#### Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		Did not observe equipment containing hazardous materials mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)				X	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.

HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Did not observe any piping or ductwork conveying hazardous materials.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)				X	It is unknown if there are shutoff valves for piping containing hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)				X	Did not observe any hazardous material ductwork and piping. Further investigation may be appropriate to mitigate seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)			X		Building has no seismic joints.

#### Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)				X	Limited details available on existing drawings. Unclear if partitions are reinforced (an example is detail 7/A7). Investigate further.
P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)				X	No integrated ceiling system. Unclear how partitions are laterally supported. Further investigation may be appropriate to mitigate seismic risk.
P-3 Drift. HR-not required; LS-MH; PR-MH.	Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)				X	No details available. Further investigation may be appropriate to mitigate seismic risk.

P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		Not required for life safety performance level.
P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		Not required for life safety performance level.
P-6 Tops. HR-not required; LS-not required; PR-MH.	The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		Not required for Life Safety Performance Level

### Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> (1.1 m <sup>2</sup> ) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		Did not enter classroom wing. Gym building did not have suspended ceilings.
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> (1.1 m <sup>2</sup> ) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		Did not enter classroom wing. Gym building did not have suspended ceilings.
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required for life safety performance level.
C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required for life safety performance level.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required for life safety performance level.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required for Life Safety Performance Level

C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft <sup>2</sup> (232.3 m <sup>2</sup> ) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required for life safety performance level.
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### Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)				X	Did not enter classroom wing. Gym building did not have suspended ceilings. Further investigation may be appropriate to mitigate seismic risk.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required for life safety performance level.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required for Life Safety Performance Level

### Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft <sup>2</sup> (0.48 kN/m <sup>2</sup> ) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		The building does not have any exterior cladding components.

CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		The building does not have any exterior cladding components.
CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		The building does not have any exterior cladding components.
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		The building does not have any exterior cladding components.
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		The building does not have any exterior cladding components.
CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		The building does not have any exterior cladding components.
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		The building does not have any exterior cladding components.



CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft <sup>2</sup> (1.5 m <sup>2</sup> ) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)	X				According to existing drawings, obscure wire glass is provided at clerestory windows.
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### Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft <sup>2</sup> (0.25 m <sup>2</sup> ), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)	X				According to existing drawing wall sections (Sheet A5), horizontal ties provided back to masonry backup at every third masonry block course (24" on center vertical). Horizontal spacing unknown.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)	X				According to existing drawings (Sheet A-7), veneer support angles are provided over openings.
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)	X				Expected that veneer is anchored to the backup at weakened planes since veneer anchorage is indicated on the existing drawings.
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)	X				Reinforced masonry walls are indicated as veneer backup on the existing drawings.
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		No cold formed steel stud backup at veneer.
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)			X		The condition at floors and roof is not specifically detailed on the existing drawings, but general veneer anchorage is indicated.
M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required for Life Safety Performance Level

M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required for Life Safety Performance Level
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#### Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)	X				The exterior covered walkway at the gym is separated from the building wall. The exterior covered walkway becomes a canopy at the gym entrance and is attached directly to the building. The classroom wing has a cantilevered roof which creates a covered walkway.
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)			X		
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		No appendages.

## Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)	X				A masonry "stack" is detailed on the existing drawings (12/A-6). The stack consists of 4" concrete block with 4" brick veneer. It is 3 ft x 3 ft and is approximately 45" above the roof so the stack complies with this requirement.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)				X	Existing drawings do not indicate how masonry stack is anchored at the first and second floors. Further investigation may be appropriate to mitigate seismic risk.

## Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		Masonry walls at stair enclosure are reinforced.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)	X				Concrete stairs appear to be directly tied to the surrounding walls (reference existing drawings, Sheet A-6).

## Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)			X		Does not appear that there are any industrial storage racks taller than 12 feet in the building.

CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)				X	Did not observe, district to confirm. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)				X	Did not observe, district to confirm. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required for life safety performance level.
CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required for life safety performance level.
CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required for life safety performance level.

#### Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)				X	Some equipment in the mechanical rooms did not appear to be braced. Bracing required for equipment weighing more than 20 lb located 4 feet or more above the floor to mitigate seismic risk.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	Unclear if in-line equipment was braced as required. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.

ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)				X	Did not observe that any of the equipment falls into this category, but this should be confirmed. Brace tops of tall narrow equipment taller than 6 feet to nearest backing wall, provide overturning base restraint.
ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required for life safety performance level.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required for life safety performance level.
ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required for life safety performance level.
ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required for life safety performance level.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required for life safety performance level.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required for life safety performance level.

### Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required for life safety performance level.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required for life safety performance level.
PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required for Life Safety Performance Level

PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required for life safety performance level.
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### Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft <sup>2</sup> (0.56 m <sup>2</sup> ) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required for Life Safety Performance Level
D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required for Life Safety Performance Level
D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required for life safety performance level.

### Elevators

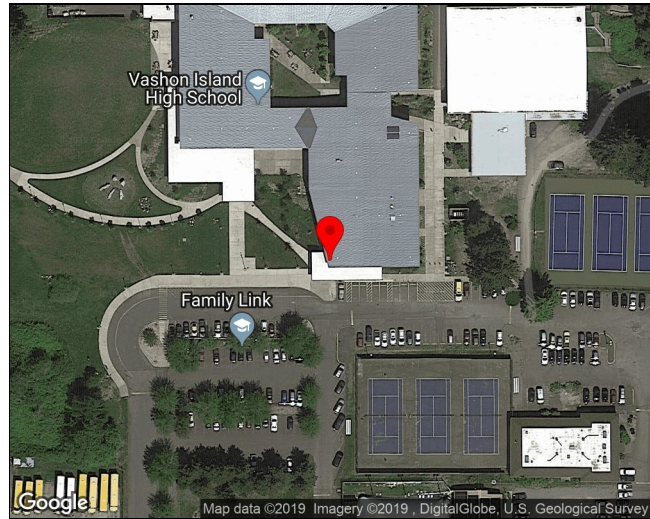
EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)			X		No elevator in building.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)			X		No elevator in building.
EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required for life safety performance level.
EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required for life safety performance level.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required for Life Safety Performance Level

EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required for life safety performance level.
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required for Life Safety Performance Level
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required for life safety performance level.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required for life safety performance level.

# 1. Vashon Island, Vashon Island High School, Building K - Annex

## 1.1 Building Description

Building Name:	Building K - Annex
Facility Name:	Vashon Island High School
District Name:	Vashon Island
ICOS Latitude:	47.423
ICOS Longitude:	-122.457
ICOS	
County/District ID:	17402
ICOS Building ID:	20352
ASCE 41 Bldg Type:	W2
Enrollment:	596
Gross Sq. Ft. :	4,677
Year Built:	1963
Number of Stories:	1
S <sub>XS</sub> BSE-2E:	1.049
S <sub>X1</sub> BSE-2E:	0.565
ASCE 41 Level of Seismicity:	High
Site Class:	C
V <sub>S30</sub> (m/s):	375
Liquefaction Potential:	very low
Tsunami Risk:	Extremely Low
Structural Drawings Available:	No
Evaluating Firm:	BergerABAM/WSP



Building K is a one-story wood frame building that serves as an annex with several classrooms. The wood frame roof consists of 5/8" thick plywood over 2x6 at 16" oc joists over 5-1/4x14-1/2" wood beams at 8 ft on center. The glulam beams are supported by 5-1/4 x 5-1/2 glulam posts. The exterior walls are 2x6 studs with plywood sheathing and brick veneer. The floor framing is 1-1/8" plywood over 3x8 at 32" oc floor joists. There is a section of floor framing that has 4x8 at 16" oc joists. There is a crawl space under the floor with posts down to continuous footings. The footing steps as required for the grade change.



### 1.1.1 Building Use

Building K is a one-story annex with several classrooms. Vashon High School houses roughly 600 students, grades 9-12. The campus includes multiple separate use buildings including the main classroom/administration building (completed in 2015), a gym (Building D), a storage space (Building F) and the annex (Building K). The K building was under construction/refurbishment while we were there.

### 1.1.2 Structural System

**Table 1.1-1. Structural System Description of Vashon Island High School**

Structural System	Description
Structural Roof	The structural roof framing consists of 5/8" plywood sheathing over wood joists over glulam beams.
Structural Floor(s)	The structural floor consists of 1-1/8" plywood sheathing over wood joists supported by posts.
Foundations	The foundations are continuous footings at both exterior and interior bearing lines.
Gravity System	The gravity system consists of wood framing (joists/beams/posts/bearing walls).
Lateral System	The lateral force resisting system consists of plywood roof and floor diaphragms with plywood shear walls.

### 1.1.3 Structural System Visual Condition

**Table 1.1-2. Structural System Condition Description of Vashon Island High School**

Structural System	Description
Structural Roof	Overall roof condition unknown. Plywood sheathing exposed at roof overhangs showed effects of exposure to weather.
Structural Floor(s)	No visible signs of corrosion damage or deterioration. From our drawing review and crawl space investigation, it appears the joist/support connections could be upgraded to meet current codes.
Foundations	Unknown
Gravity System	No visible signs of corrosion damage or deterioration. Connections could be improved to better meet modern day code.
Lateral System	No visible signs of corrosion damage or deterioration. Lateral system at east and west walls (mostly windows) is unclear.

## 1.2 Seismic Evaluation Findings

### 1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

**Table 1-3. Identified Structural Seismic Deficiencies for Vashon Island Vashon Island High School Building K - Annex**

Deficiency	Description
Overturning	$0.6S_a = 0.63$ which is much less than the ratio of base to height (approximately 6). Recommend further investigation.
Shear Stress Check	The Quick Check procedure shear stress calculation indicates the structural panel sheathed shear walls are just over 1,000 lb/ft. Further investigation is recommended.
Cripple Walls	Center wall acts as a shear wall. Some X bracing installed at crawl space, but not full length. Further upgrade of lateral force resisting system load path recommended.
Openings	Exterior east and west walls are primarily windows. The center spine wall resists the lateral forces. Limited structural drawings do not show a clear load path from roof to center spine wall. Recommend further investigation. The wood sheathed roof diaphragm transfers lateral loads to the center spine wall.
Girder-Column Connection	Structural drawings (Sheet S2) indicate pipe dowels provided for roof beam to column at exterior wall. Recommend upgrade with additional straps or plates.

### 1.2.2 Structural Checklist Items Marked as 'U'nknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

**Table 1-4. Identified Structural Checklist Items Marked as Unknown for Vashon Island Vashon Island High School Building K - Annex**

Unknown Item	Description
Load Path	The available drawings indicate a load path that could be improved with the addition of ties or straps at member connections. According to the drawings, there is limited bracing in the crawl space for load transfer.
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Site slopes away (down) to the east, therefore it is assumed that earthquake-induced slope failures or rockfalls could be an issue for this building. Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Walls Connected Through Floors	One-story building with crawl space. Lateral force resisting strength at the crawl space should be further investigated.
Wood Posts	Limited structural drawings available indicate these connections could be improved with plates or straps
Roof Chord Continuity	Structural drawings do not indicate this level of detail.

1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-5. Identified Nonstructural Seismic Deficiencies for Vashon Island Vashon Island High School Building K - Annex

Deficiency	Description
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The Tier 1 nonstructural seismic evaluation performed for this school building could not confirm nonstructural seismic deficiencies due to limited access for visual observation and/or lack of existing drawings available for review. Please refer to the next page of this report for the list of nonstructural items marked as “unknown” and commentary indicating the need for further investigation or the likelihood of compliance or non-compliance based on the age of construction.

### 1.3.2 Nonstructural Checklist Items Marked as 'Unknown'

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

**Table 1-6. Identified Nonstructural Checklist Items Marked as Unknown for Vashon Island Vashon Island High School Building K - Annex**

Unknown Item	Description
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant due to year of construction (1963).
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant due to year of construction (1963).
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Not detailed on available drawings or visually verified during site visit. See Report documents (including Appendix) for bracing guidance. Assumed to be noncompliant due to year of construction (1963).
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	No stairs.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	No panelized ceilings. Not detailed on drawings.
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Did not observe equipment mounted on vibration isolators and containing hazardous material. District to confirm. See Report documents (including Appendix) for bracing guidance.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Did not observe breakable containers with hazardous materials. District to confirm. See Report documents (including Appendix) for bracing guidance.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Did not observe piping or ductwork conveying hazardous materials. District to confirm. See Report documents (including Appendix) for bracing guidance.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Did not observe but most likely compliant. District to confirm.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Did not observe flexible couplings. District to confirm. See Report documents (including Appendix) for bracing guidance.
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Available drawings did not include brick veneer anchorage detail. Recommend further investigation.
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Available drawings did not include brick veneer anchorage detail. Recommend further investigation.
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Building under construction/renovation, regular contents not observed. See Report documents (including Appendix) for bracing guidance.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Building under construction/renovation, regular contents not observed. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.

Unknown Item	Description
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Building under construction/renovation, regular contents not observed. Heavy items on upper shelves should be restrained by netting or cabling to avoid becoming falling hazards.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Building under construction/renovation, mechanical and electrical equipment not observed.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Building under construction/renovation, mechanical and electrical equipment not observed.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Building under construction/renovation, mechanical and electrical equipment not observed. Brace tops of tall narrow equipment taller than 6 feet to nearest backing wall, provide overturning base restraint.

Photos:



**Figure 1-1. Building K - West face**



**Figure 1-2. West wall exterior**





**Figure 1-3. Covered exterior sidewalk**



**Figure 1-4. East wall - grade slopes away from building**





**Figure 1-5. Crawl space floor framing support on continuous footing**



**Figure 1-6. Crawl space joist support at interior bearing**



Figure 1-7. Floor framing support column and footing



**Figure 1-8. Crawl space pipe support**



**Figure 1-9. Roof framing - (classroom under construction)**



## Vashon Island, Vashon Island High School, Building K - Annex

### 17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

#### Low Seismicity

##### Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)				X	The available drawings indicate a load path that could be improved with the addition of ties or straps at member connections. According to the drawings, there is limited bracing in the crawl space for load transfer.
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	X				No adjacent buildings.
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)			X		No mezzanine.

##### Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Weak Story	The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)			X		One-story building.
Soft Story	The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)			X		One-story building.

Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)	X				Load path in the crawl space could be improved.
Geometry	There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)			X		One-story building.
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)			X		One-story building.
Torsion	The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)	X				The wood frame building flexible diaphragm will transfer lateral loads to wood shear walls by tributary area. Unclear if the center shear wall takes all of the lateral load in the north-south direction since the east and west walls are mostly windows.

### **Moderate Seismicity** (Complete the Following Items in Addition to the Items for Low Seismicity)

#### **Geologic Site Hazards**

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. Very low liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.

Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)				X	Site slopes away (down) to the east, therefore it is assumed that earthquake-induced slope failures or rockfalls could be an issue for this building. Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure.
Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

### High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

#### Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)		X			$0.6S_a = 0.63$ which is much less than the ratio of base to height (approximately 6). Recommend further investigation.
Ties Between Foundation Elements	The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)	X				Foundations in the crawl space are restrained by soils classified as Site Class C. Further investigation is warranted to confirm foundations are buried and not sitting on top of the soil.

## 17-6 Collapse Prevention Structural Checklist for Building Type W2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

### Low and Moderate Seismicity

#### Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				The flexible diaphragm will distribute the loads to the shear walls on a tributary area basis. There is one long central spine shear wall in the north-south direction.
Shear Stress Check	The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the following values: Structural panel sheathing – 1,000 lb/ft; Diagonal sheathing – 700 lb/ft; Straight sheathing – 100 lb/ft; All other conditions – 100 lb/ft. (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.7.1)		X			The Quick Check procedure shear stress calculation indicates the structural panel sheathed shear walls are just over 1,000 lb/ft. Further investigation is recommended.
Stucco (Exterior Plaster) Shear Walls	Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.2)	X				Wood sheathed shear walls provided.
Gypsum Wallboard or Plaster Shear Walls	Interior plaster or gypsum wallboard is not used for shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.3)	X				One-story building.
Narrow Wood Shear Walls	Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Tier 2: Sec. 5.5.3.6.1; Commentary: Sec. A.3.2.7.4)	X				Central spine wall runs north-south direction. North and South walls resist lateral forces in the east-west direction.
Walls Connected Through Floors	Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Tier 2: Sec. 5.5.3.6.2; Commentary: Sec. A.3.2.7.5)				X	One-story building with crawl space. Lateral force resisting strength at the crawl space should be further investigated.
Hillside Site	For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Tier 2: Sec. 5.5.3.6.3; Commentary: Sec. A.3.2.7.6)			X		Building on flat site, slopes down to the east outside the building footprint.



Cripple Walls	Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Tier 2: Sec. 5.5.3.6.4; Commentary: Sec. A.3.2.7.7)		X			Center wall acts as a shear wall. Some X bracing installed at crawl space, but not full length. Further upgrade of lateral force resisting system load path recommended.
Openings	Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Tier 2: Sec. 5.5.3.6.5; Commentary: Sec. A.3.2.7.8)		X			Exterior east and west walls are primarily windows. The center spine wall resists the lateral forces. Limited structural drawings do not show a clear load path from roof to center spine wall. Recommend further investigation. The wood sheathed roof diaphragm transfers lateral loads to the center spine wall.

#### Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Wood Posts	There is a positive connection of wood posts to the foundation. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.3)				X	Limited structural drawings available indicate these connections could be improved with plates or straps
Wood Sills	All wood sills are bolted to the foundation. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.4)	X				Structural drawings indicate 2x wood plate with 5/8-inch diameter anchor bolt at 36 inches on center spacing.
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)		X			Structural drawings (Sheet S2) indicate pipe dowels provided for roof beam to column at exterior wall. Recommend upgrade with additional straps or plates.

### High Seismicity (Complete the Following Items in Addition to the Items for Low & Moderate Seismicity)

#### Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Wood Sill Bolts	Sill bolts are spaced at 6 ft (1.8 m) or less with acceptable edge and end distance provided for wood and concrete. (Tier 2: Sec. 5.7.3.3; Commentary: Sec. A.5.3.7)	X				Structural drawings indicate 2x wood plate with 5/8-inch diameter anchor bolt at 36 inches on center spacing.

#### Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Diaphragm Continuity	The diaphragms are not composed of split-level floors and do not have expansion joints. (Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.1)	X				One-story building, no split-level floors or expansion joints.
Roof Chord Continuity	All chord elements are continuous, regardless of changes in roof elevation. (Tier 2: Sec. 5.6.1.1; Commentary: Sec. A.4.1.3)				X	Structural drawings do not indicate this level of detail.
Diaphragm Reinforcement at Openings	There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Tier 2: Sec. 5.6.1.5; Commentary: Sec. A.4.1.8)			X		No large diaphragm openings.
Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)			X		No straight sheathing.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)	X				Wood diaphragms consists of wood structural panels.
Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and have aspect ratios less than or equal to 4-to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)	X				Transfer of lateral forces from the roof diaphragm to the center spine wall in the north-south direction is unclear from the available structural drawings. Further investigation recommended.
Other Diaphragms	The diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				Wood frame roof and floor diaphragm provided.

## Vashon Island, Vashon Island High School, Building K - Annex

### 17-38 Nonstructural Checklist

Notes:

C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

Level of Seismicity: L = Low, M = Moderate, and H = High

#### Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on year of construction (1957) of the building, it is assumed that seismic bracing for fire suppression piping does not comply with NFPA 13. Further investigation may be appropriate to mitigate seismic risk.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)		X			No available record drawing information on fire suppression piping and unable to verify during site investigation. Based on age of the building, it is assumed the flexible couplings on the fire suppression piping do not comply with NFPA 13. Flexible coupling for fire suppression piping may be appropriate to mitigate seismic risk.

LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Available record drawings do not have information on anchorage or bracing for emergency power equipment and could not verify during site investigation. Based on age of the building, emergency power equipment is either nonexistent or noncompliant. Evaluation of emergency power equipment may be appropriate to mitigate seismic risk.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		No enclosed stairs.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)				X	No panelized ceilings. Not detailed on drawings. Further investigation may be appropriate to mitigate seismic risk.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		Not required for Life Safety Performance Level

#### Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		Did not observe equipment containing hazardous materials mounted on vibration isolators. Further investigation may be appropriate to mitigate seismic risk.
HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)				X	Unknown whether the building has hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Did not observe any piping or ductwork conveying hazardous materials.

HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)				X	It is unknown if there are shutoff valves for piping containing hazardous materials. Further investigation may be appropriate to mitigate seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)				X	Did not observe any hazardous material ductwork and piping. Further investigation may be appropriate to mitigate seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)				X	Building has no seismic joints.

#### Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)			X		No URM partitions.
P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		No masonry or hollow-clay tile partitions supported by an integrated ceiling system observed in building.
P-3 Drift. HR-not required; LS-MH; PR-MH.	Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)			X		There were no rigid cementitious partitions observed in building.
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		Not required for life safety performance level.
P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		Not required for life safety performance level.

P-6 Tops. HR-not required; LS-not required; PR-MH.	The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		Not required for Life Safety Performance Level
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### Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> (1.1 m <sup>2</sup> ) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		There are no suspended lath and plaster ceilings.
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> (1.1 m <sup>2</sup> ) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		Gypsum board ceilings are attached directly to the underside of the roof joists.
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required for life safety performance level.
C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required for life safety performance level.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required for life safety performance level.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> (13.4 m <sup>2</sup> ) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required for Life Safety Performance Level
C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft <sup>2</sup> (232.3 m <sup>2</sup> ) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required for life safety performance level.

## Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)			X		Light fixtures are suspended and do not penetrate the ceiling.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required for life safety performance level.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required for Life Safety Performance Level

## Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft <sup>2</sup> (0.48 kN/m <sup>2</sup> ) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		The building does not have any exterior cladding components.
CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		The building does not have any exterior cladding components.

CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		The building does not have any exterior cladding components.
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		The building does not have any exterior cladding components.
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		The building does not have any exterior cladding components.
CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		The building does not have any exterior cladding components.
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		The building does not have any exterior cladding components.
CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft <sup>2</sup> (1.5 m <sup>2</sup> ) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)			X		The building does not have any glazing panes.



## Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft <sup>2</sup> (0.25 m <sup>2</sup> ), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)				X	Available drawings did not include brick veneer anchorage detail. Further investigation may be warranted to mitigate seismic risk.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)			X		One-story building. No brick over openings.
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)				X	Available drawings did not include brick veneer anchorage detail. Further investigation may be warranted to mitigate seismic risk.
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)	X				There is no unreinforced masonry backup.
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		No cold-formed steel stud backup at masonry veneer.
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)			X		No veneer with masonry backup.
M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required for Life Safety Performance Level
M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required for Life Safety Performance Level

### Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		No URM parapets or cornices.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)			X		No canopies.
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)			X		No concrete parapets.
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		No appendages (beyond vents).

### Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)			X		1963 drawings indicate brick chimney, none observed.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)			X		No chimney observed.

## Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		No stairs.
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)			X		No stairs.

## Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)				X	Building under construction/renovation, regular contents not observed.
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)				X	Building under construction/renovation, regular contents not observed. Brace tops of shelving taller than 6 feet to nearest backing wall, provide overturning base restraint.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)				X	Building under construction/renovation, regular contents not observed. Heavy items on upper shelves should be restrained by netting or cabling to avoid falling hazards.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required for life safety performance level.

CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required for life safety performance level.
CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required for life safety performance level.

### Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)				X	Building under construction/renovation, mechanical and electrical equipment not observed.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	Building under construction/renovation, mechanical and electrical equipment not observed. Bracing for heavy in-line equipment may be appropriate to mitigate seismic risk.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)				X	Building under construction/renovation, mechanical and electrical equipment not observed. Brace tops of tall narrow equipment taller than 6 feet to nearest backing wall, provide overturning base restraint.
ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required for life safety performance level.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required for life safety performance level.
ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required for life safety performance level.

ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required for life safety performance level.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required for life safety performance level.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required for life safety performance level.

### Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required for life safety performance level.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required for life safety performance level.
PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required for Life Safety Performance Level
PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required for life safety performance level.

### Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft <sup>2</sup> (0.56 m <sup>2</sup> ) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required for Life Safety Performance Level
D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required for Life Safety Performance Level

D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required for life safety performance level.
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#### Elevators

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)			X		No elevator in building.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)			X		No elevator in building.
EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required for life safety performance level.
EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required for life safety performance level.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required for Life Safety Performance Level
EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required for life safety performance level.
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required for Life Safety Performance Level
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required for life safety performance level.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required for life safety performance level.

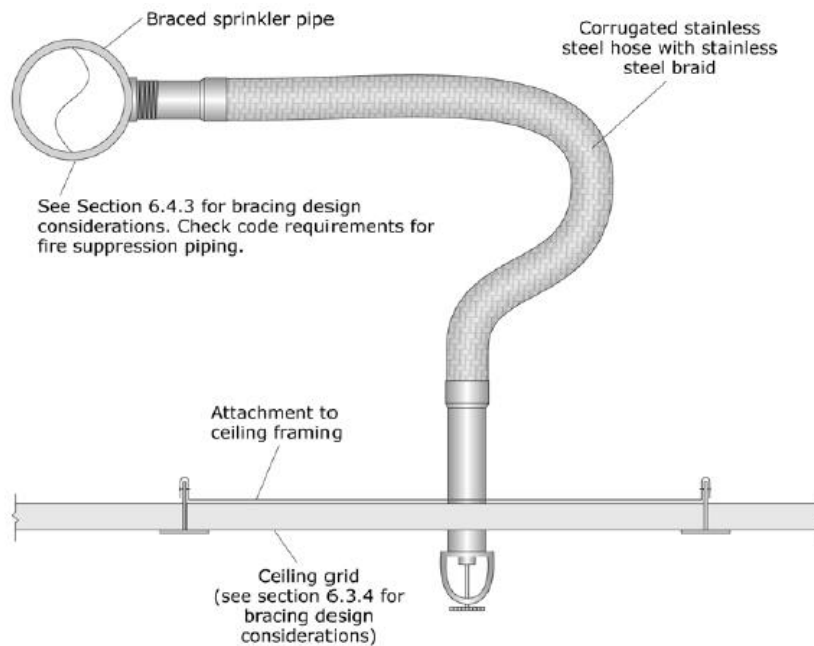
## **FEMA E-74 Nonstructural Seismic Bracing Excerpts**

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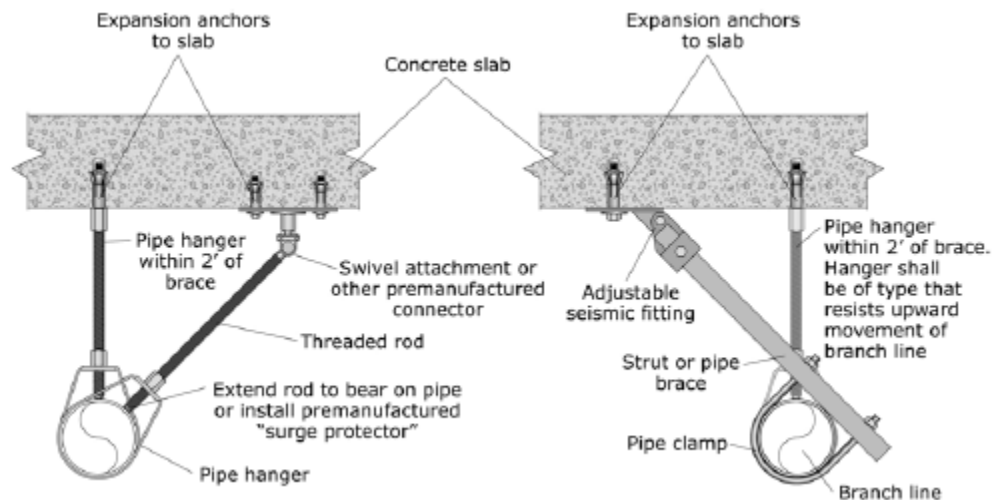
## Life Safety Systems



**Note:** for seismic design category D, E & F, the flexible sprinkler hose fitting must accommodate at least 1" of ceiling movement without use of an oversized opening. Alternatively, the sprinkler head must have a 2" oversize ring or adapter that allows 1" movement in all directions.

**Figure G-1. Flexible Sprinkler Drop.**

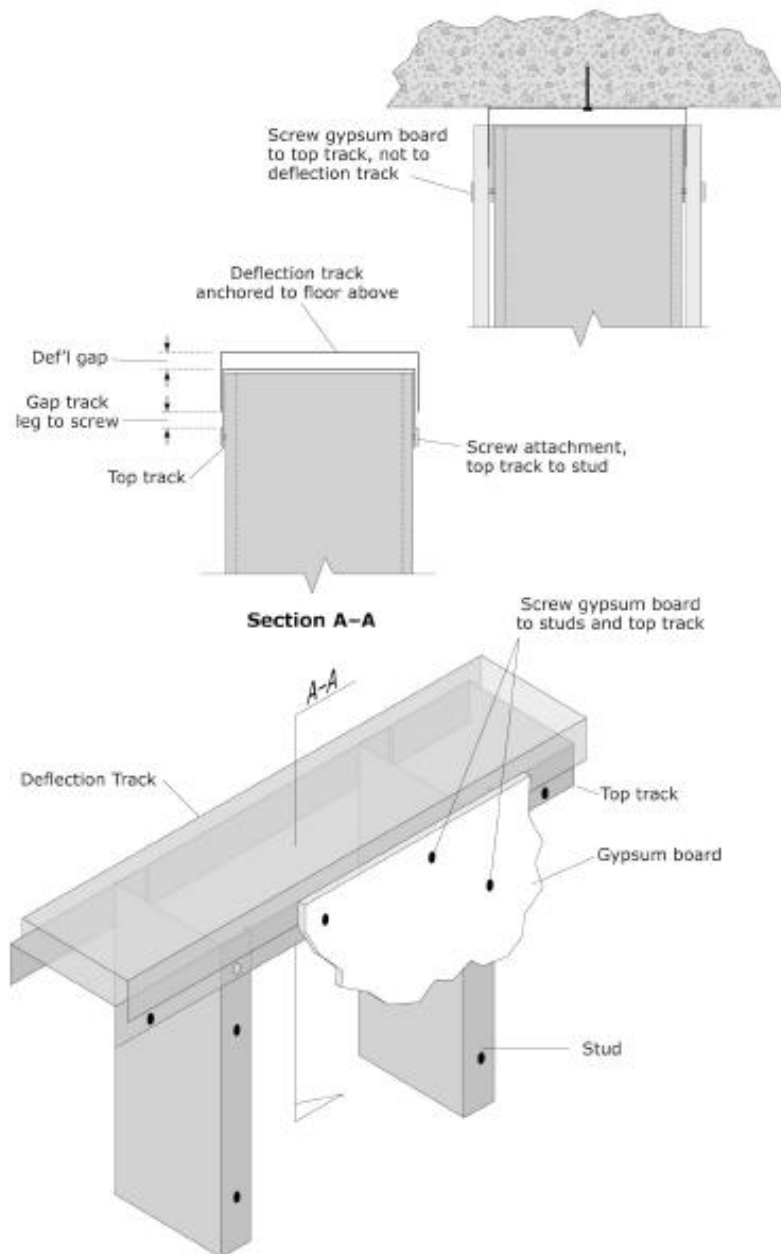
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



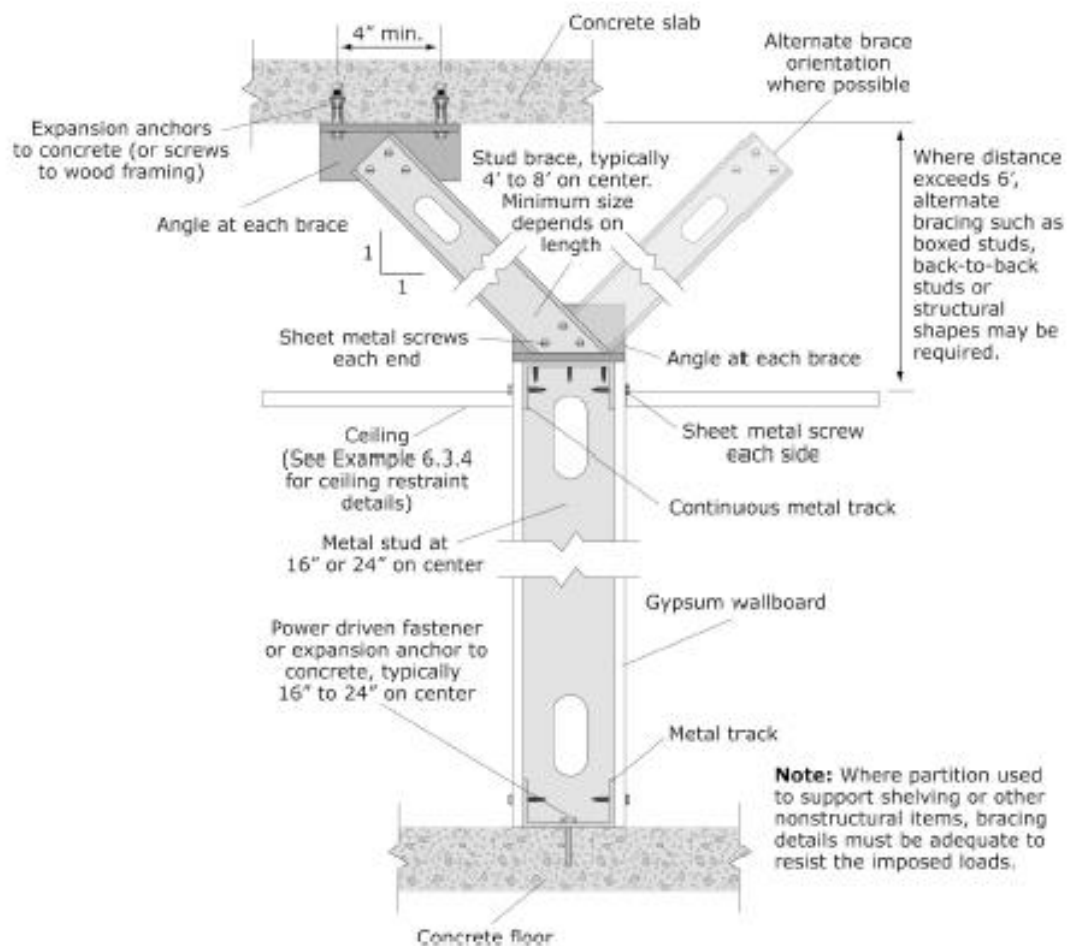
**Figure G-2. End of Line Restraint.**

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

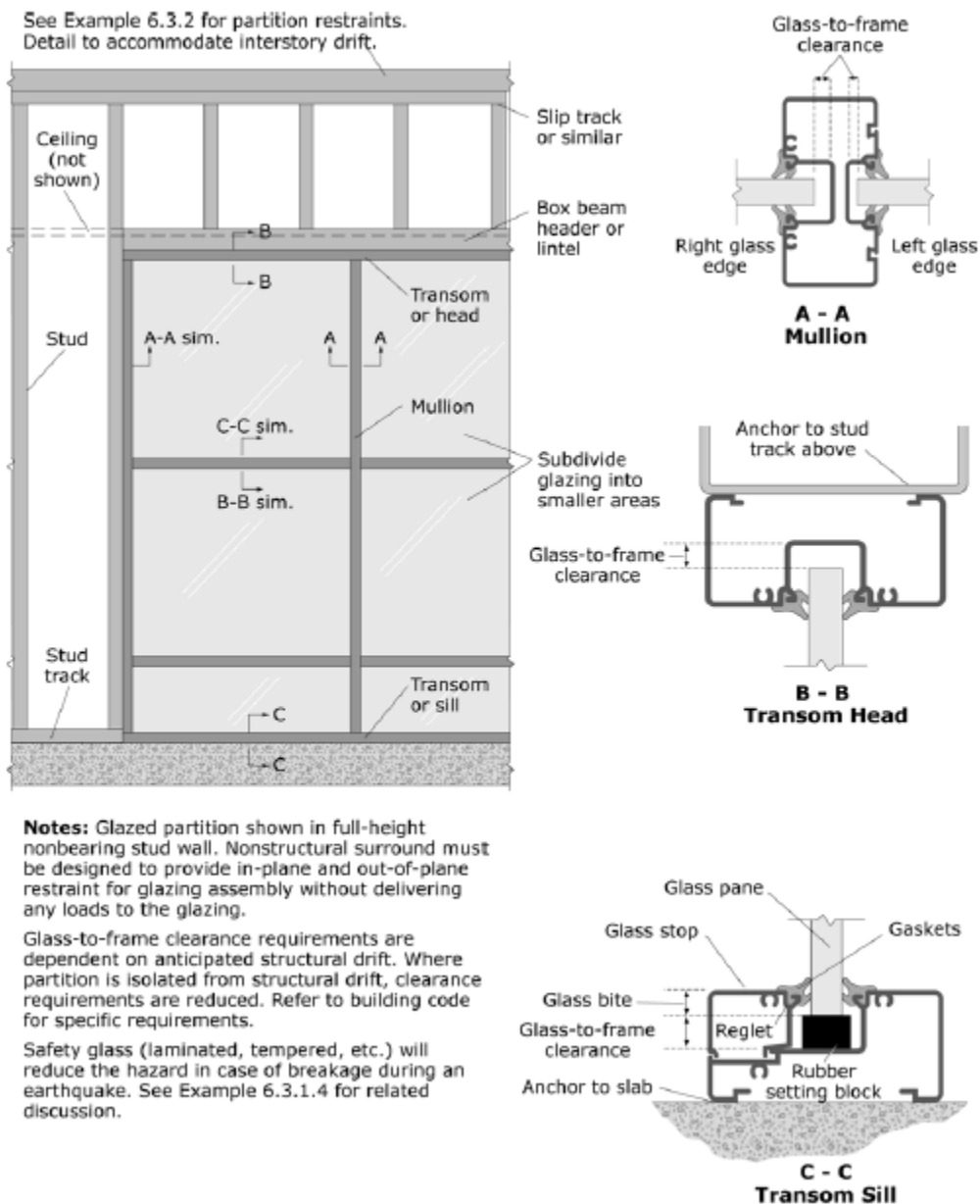
## Partitions



**Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

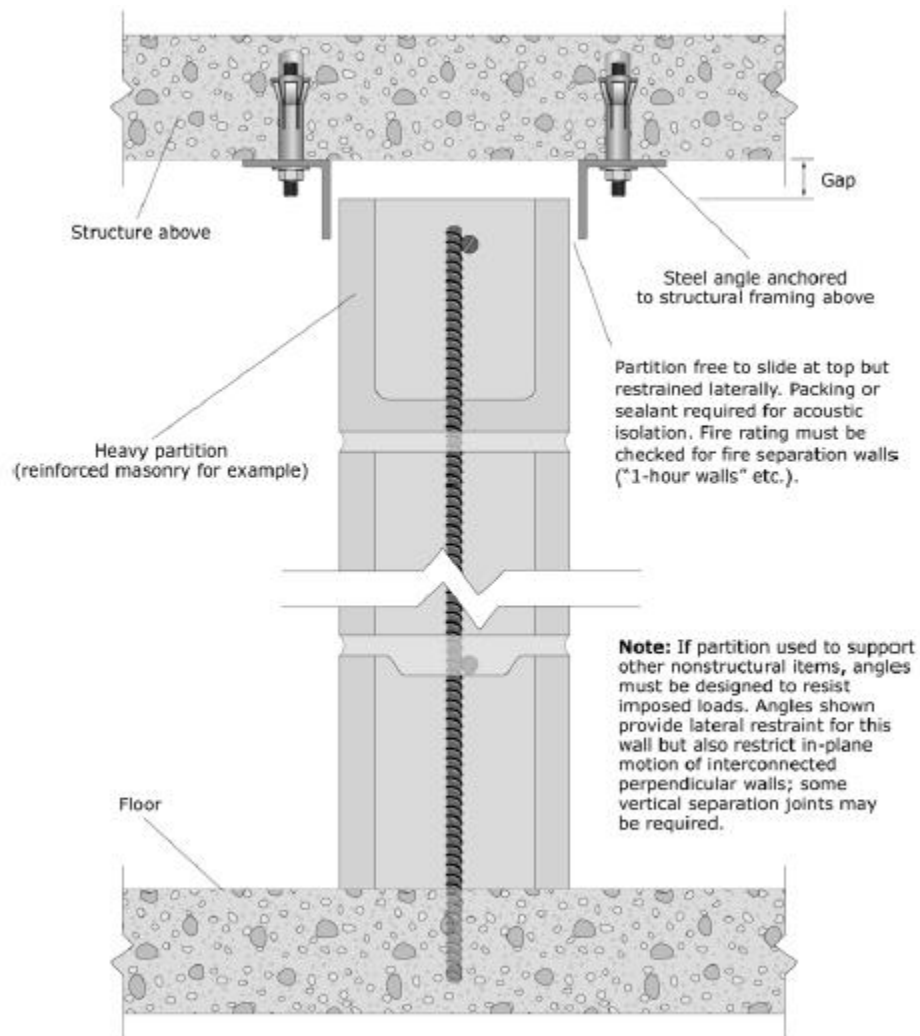


**Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partition Walls.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

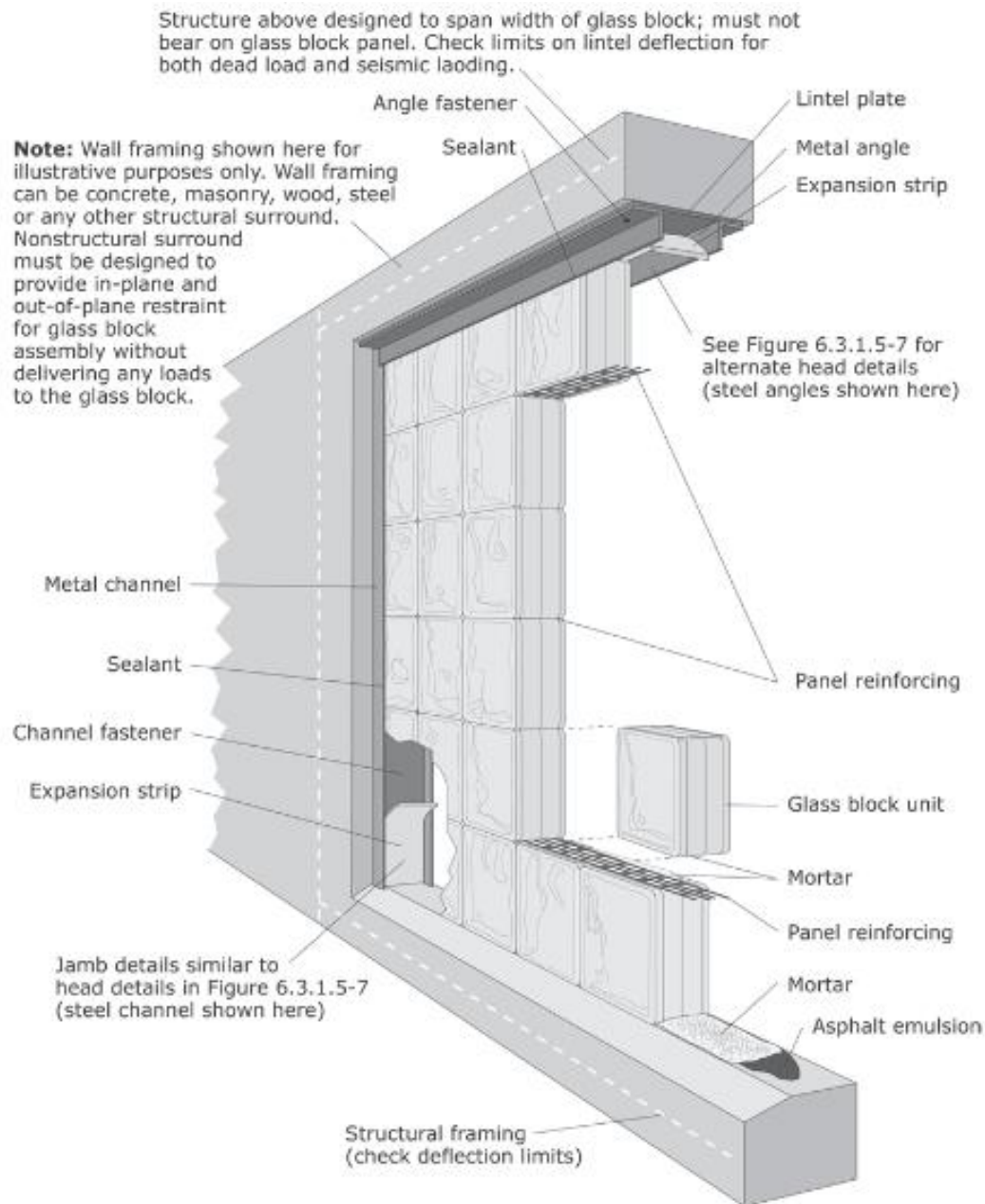


**Figure G-5. Full-height Glazed Partition.**

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

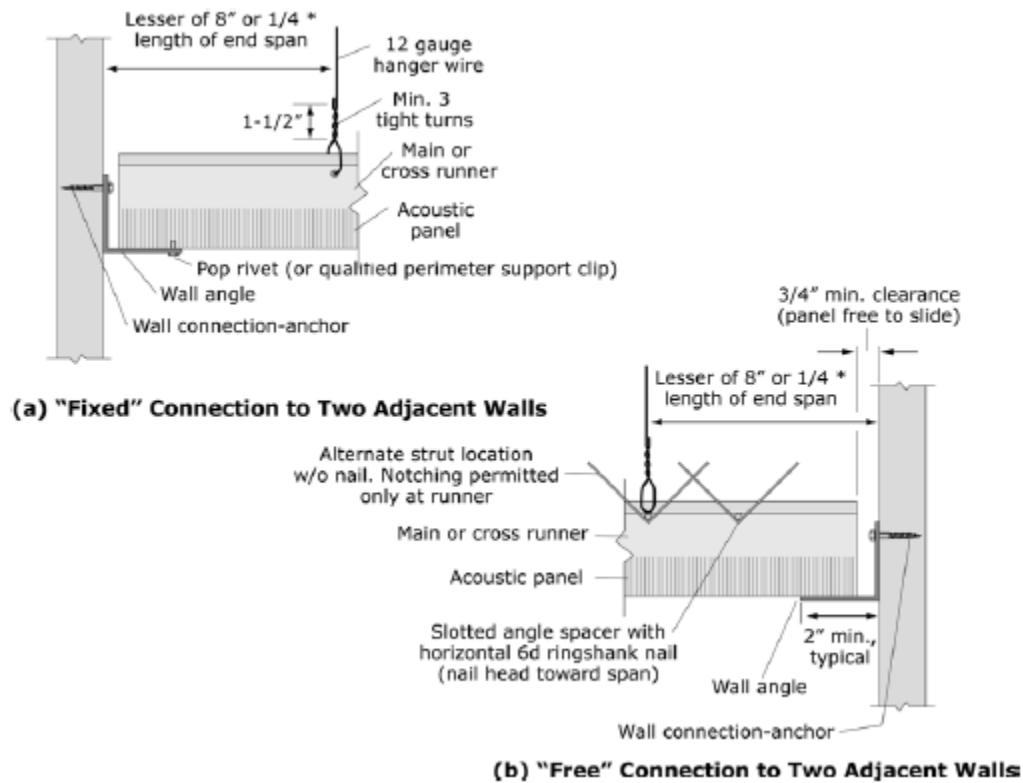


**Figure G-6. Full-height Heavy Partition.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



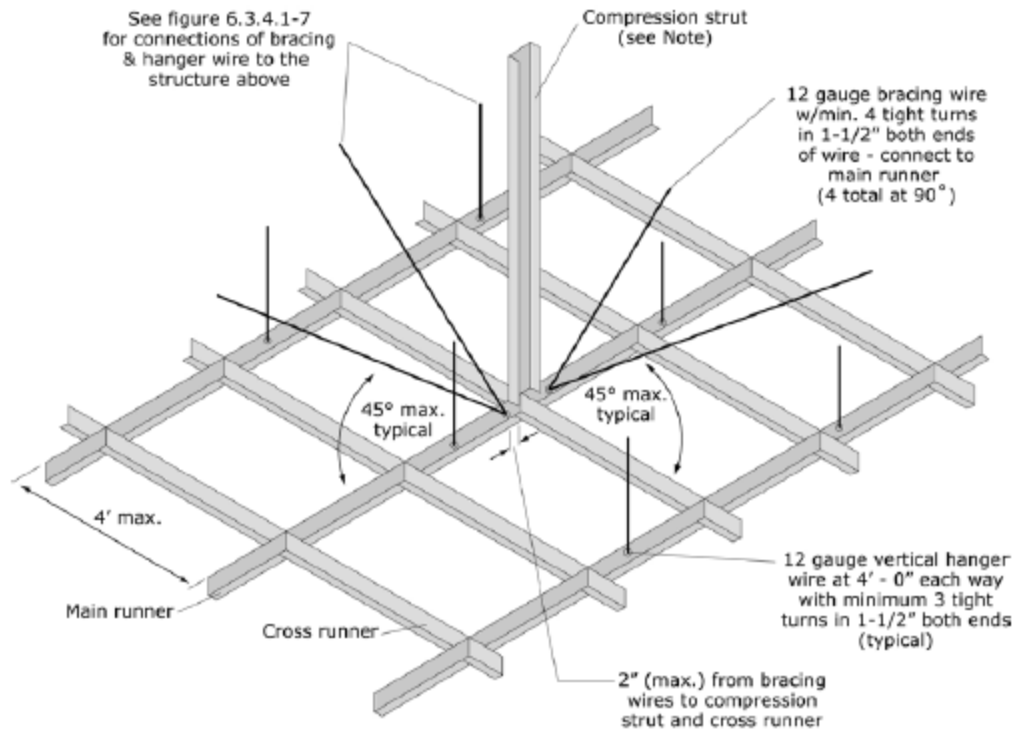
**Figure G-7. Typical Glass Block Panel Details.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

## Ceilings



**Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

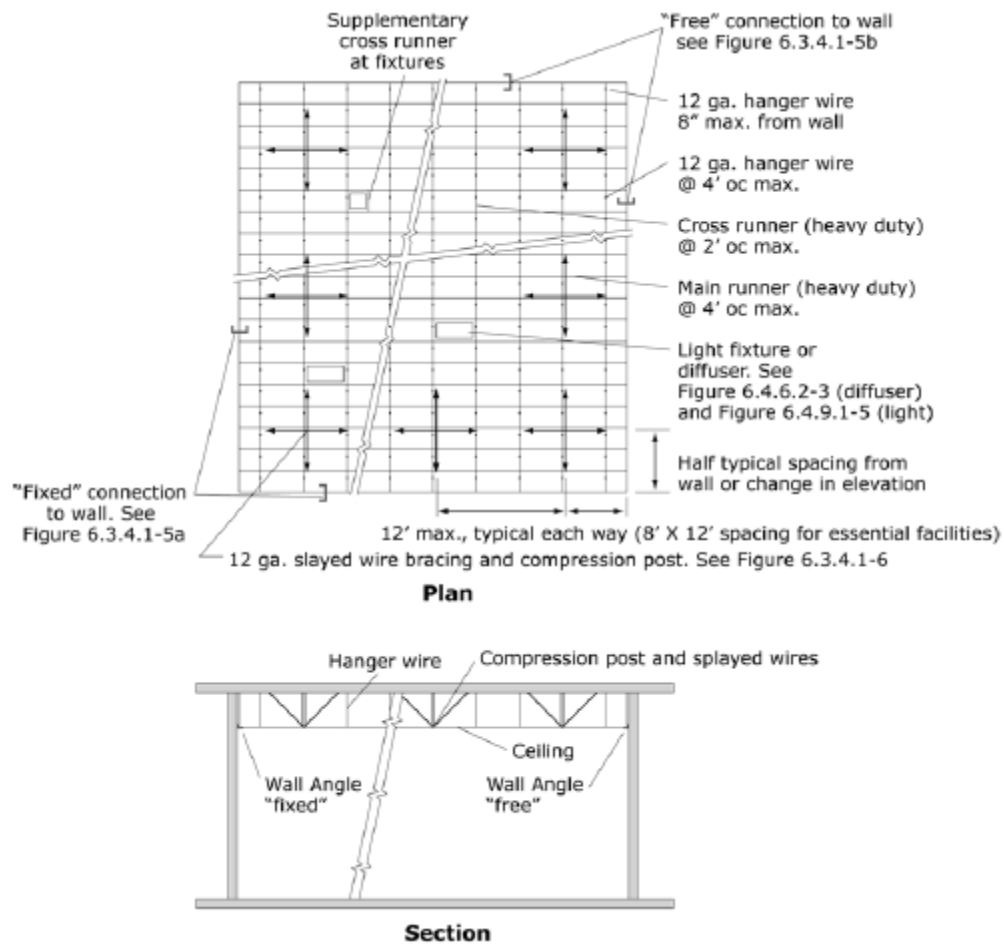




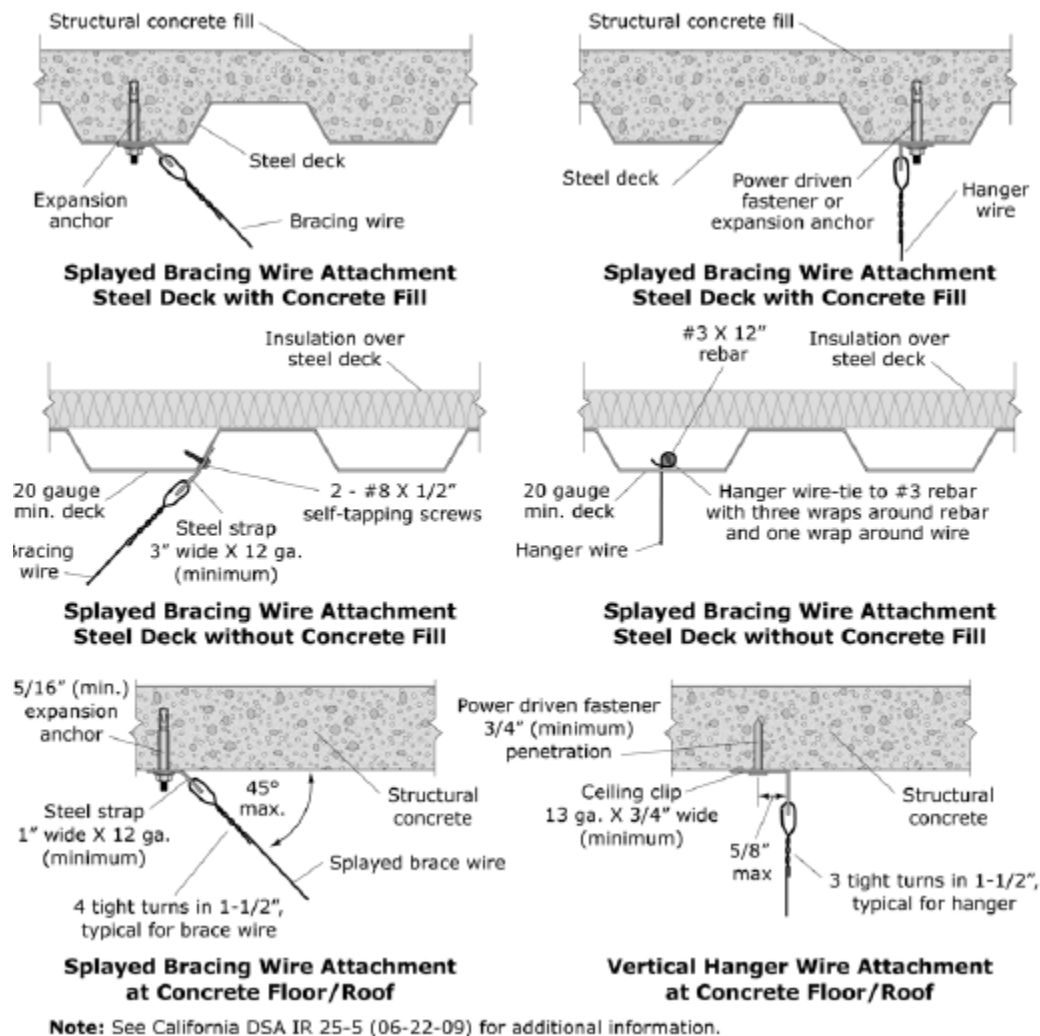
**Note:** Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to structure. Size of strut is dependent on distance between ceiling and structure ( $l/r \leq 200$ ). A 1" diameter conduit can be used for up to 6'; a 1-5/8" X 1-1/4" metal stud can be used for up to 10'

Per DSA IR 25-5, ceiling areas less than 144 sq. ft. or fire rated ceilings less than 96 sq. ft., surrounded by walls braced to the structure above do not require lateral bracing assemblies when they are attached to two adjacent walls. (ASTM E580 does not require lateral bracing assemblies for ceilings less than 1000 sq. ft.; see text.)

**Figure G-9. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Assembly.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

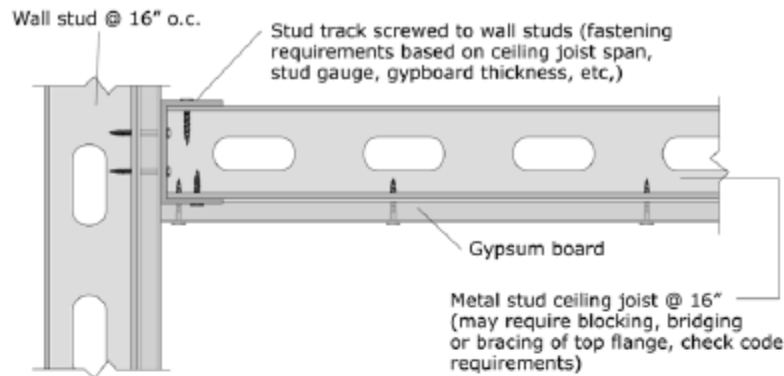


**Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

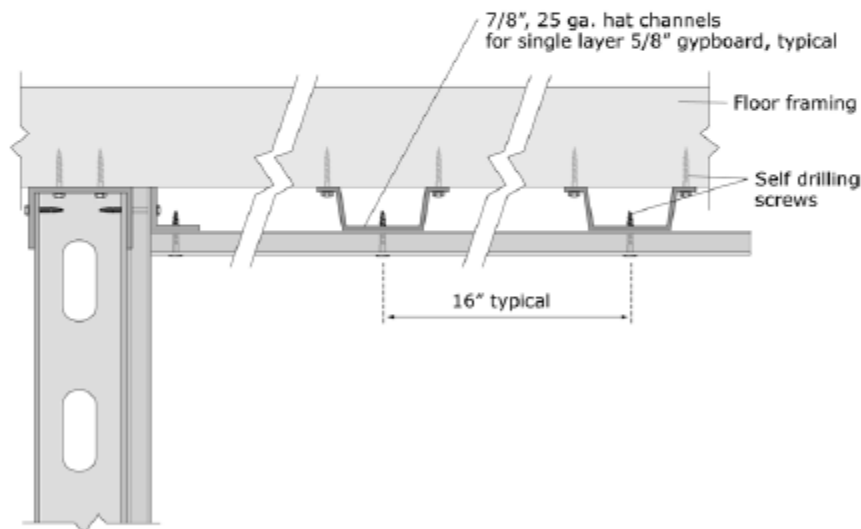


**Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.**

*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



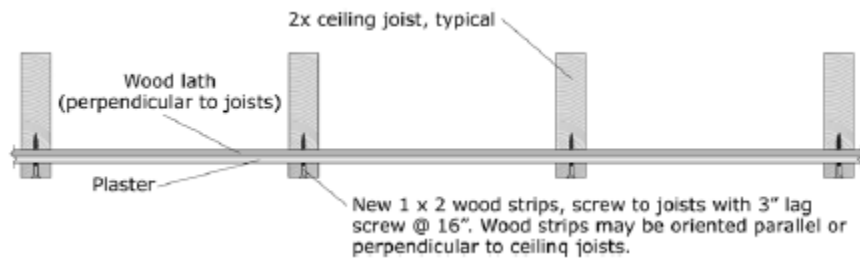
**a) Gypsum board attached directly to ceiling joists**



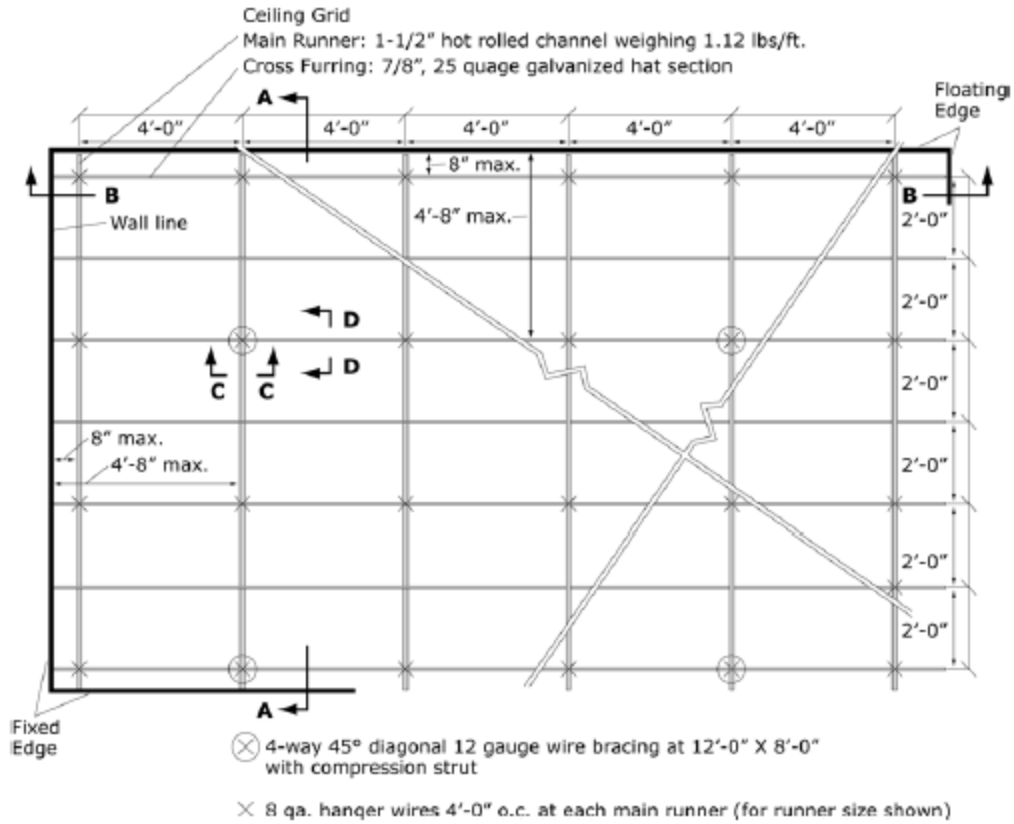
**b) Gypsum board attached directly to furring strips (hat channel or similar)**

Note: Commonly used details shown; no special seismic details are required as long as furring and gypboard secured. Check for certified assemblies (UL listed, FM approved, etc.) if fire or sound rating required.

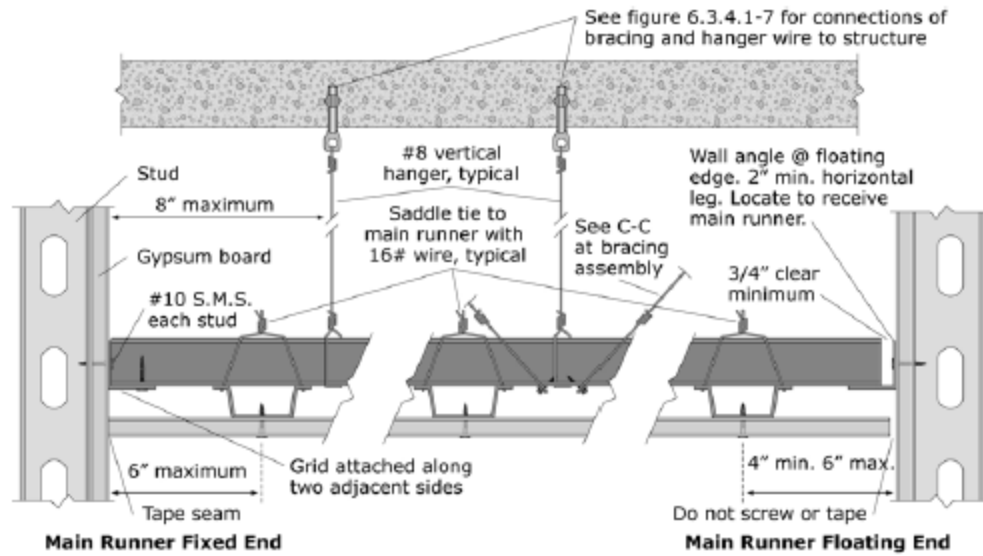
**Figure G-12. Gypsum Board Ceiling Applied Directly to Structure.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



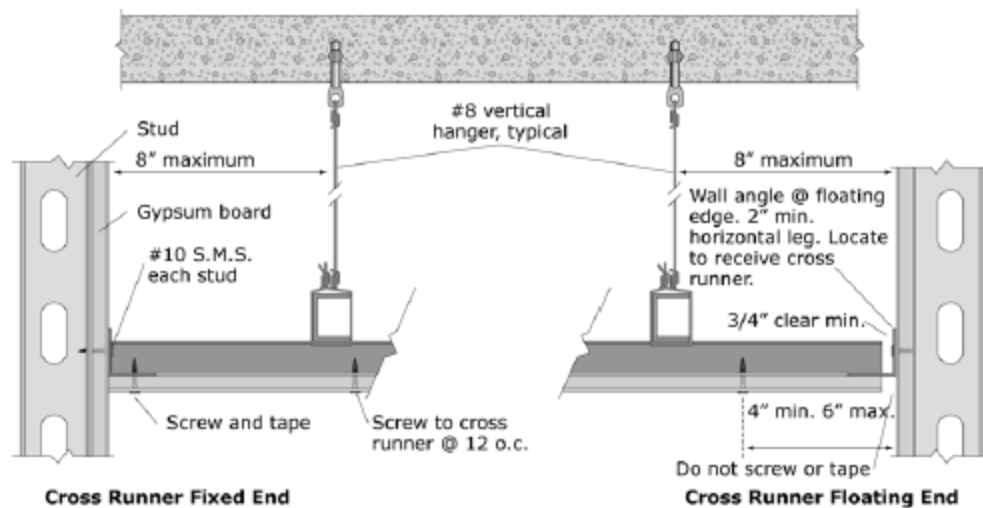
**Figure G-13. Retrofit Detail for Existing Lath and Plaster.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



**Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

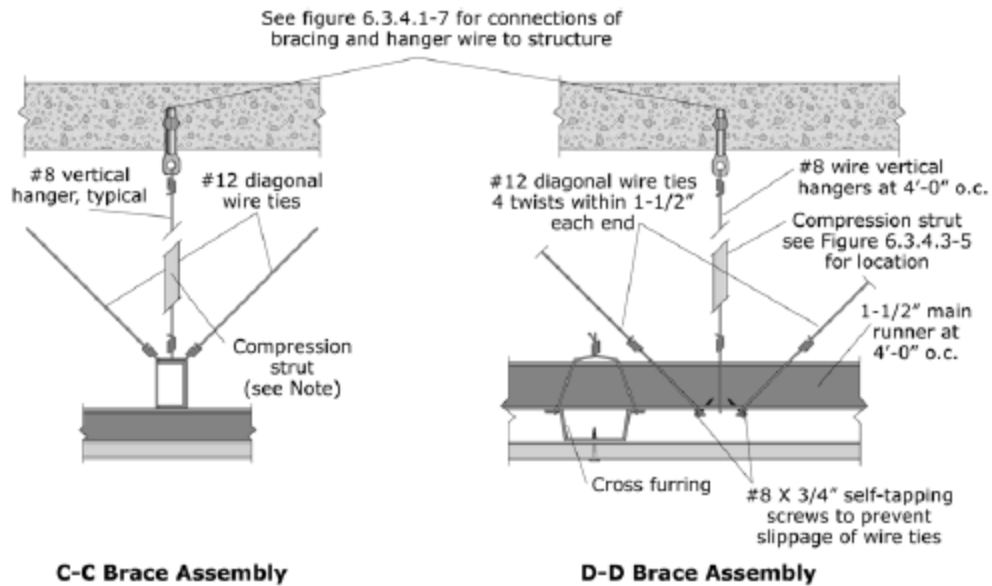


**A-A Main Runner at Perimeter**



**B-B Cross Runner at Perimeter**

**Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

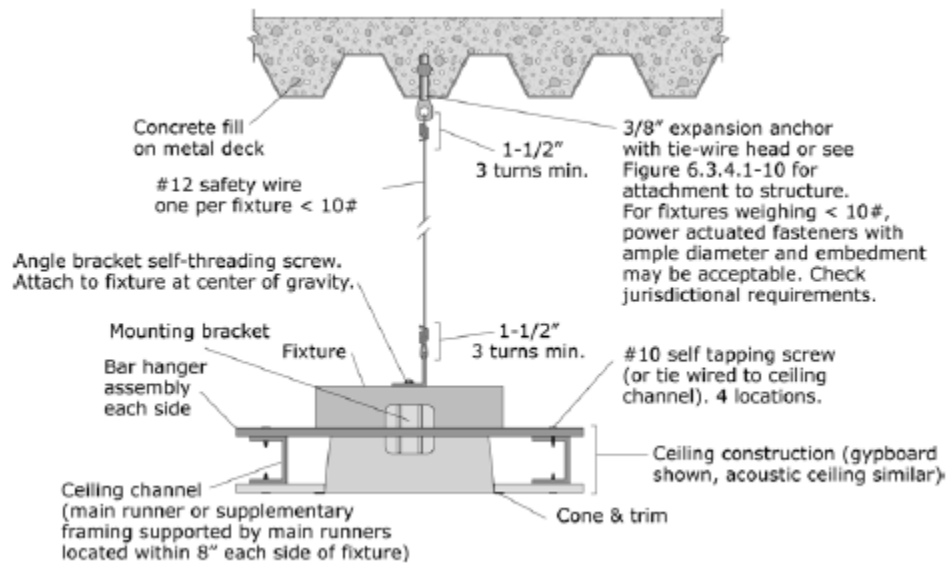


**Note:** Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to concrete. Size of strut is dependent on distance between ceiling and structure ( $l/r \leq 200$ ). A 1" diameter conduit can be used for up to 6', a 1-5/8" X 1-1/4" metal stud can be used for up to 10'. See figure 6.3.4.1-6 for example of bracing assembly.

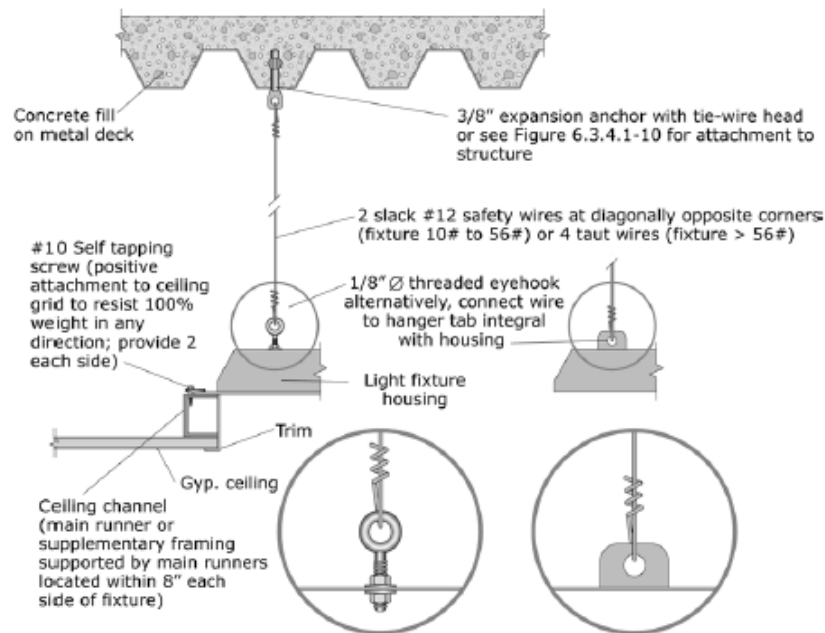
**Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.**  
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



## Light Fixtures

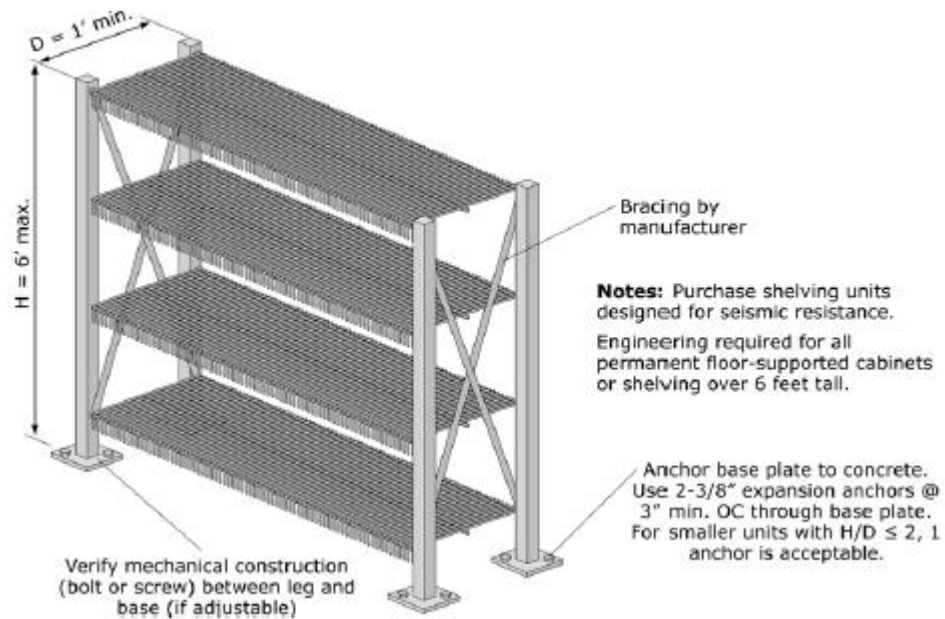


**Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).**  
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

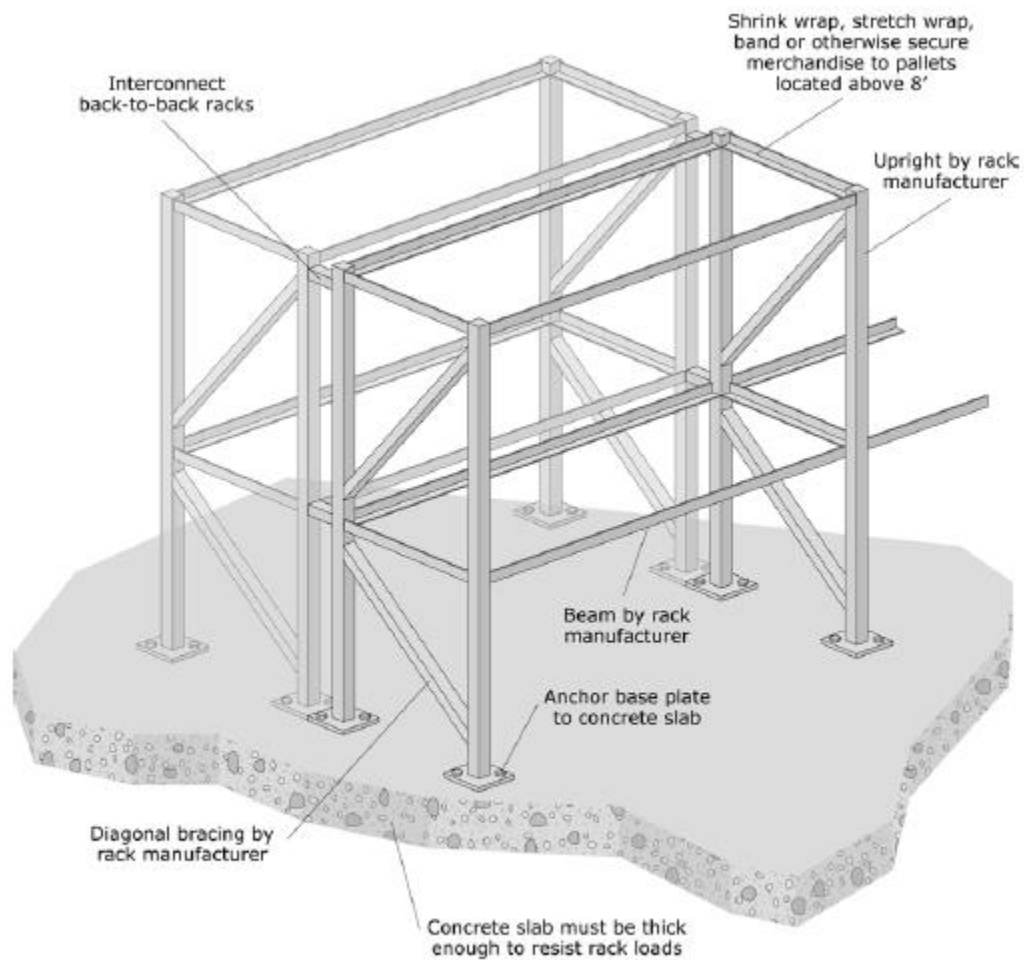


**Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).**  
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

## Contents and Furnishings

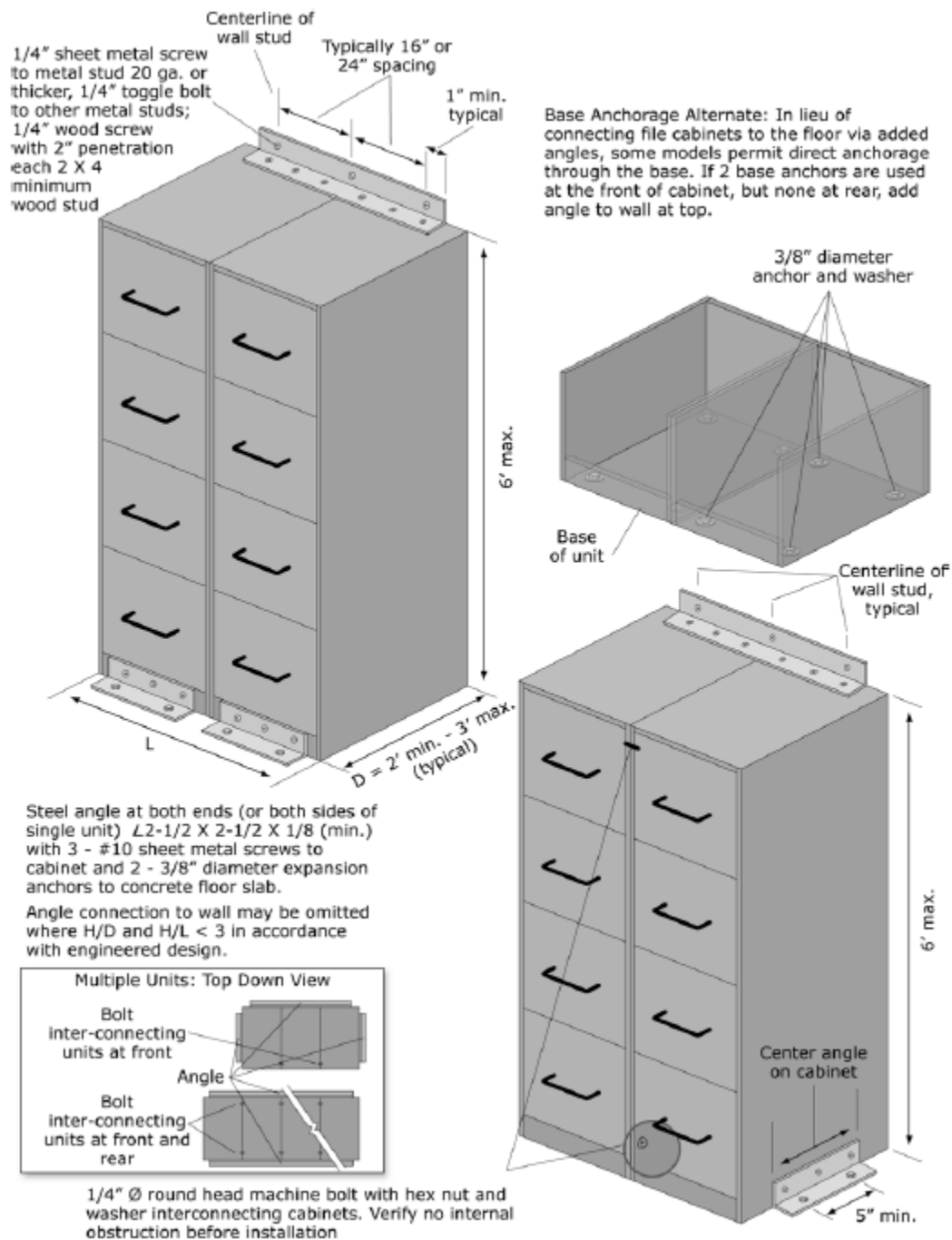


**Figure G-19. Light Storage Racks.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

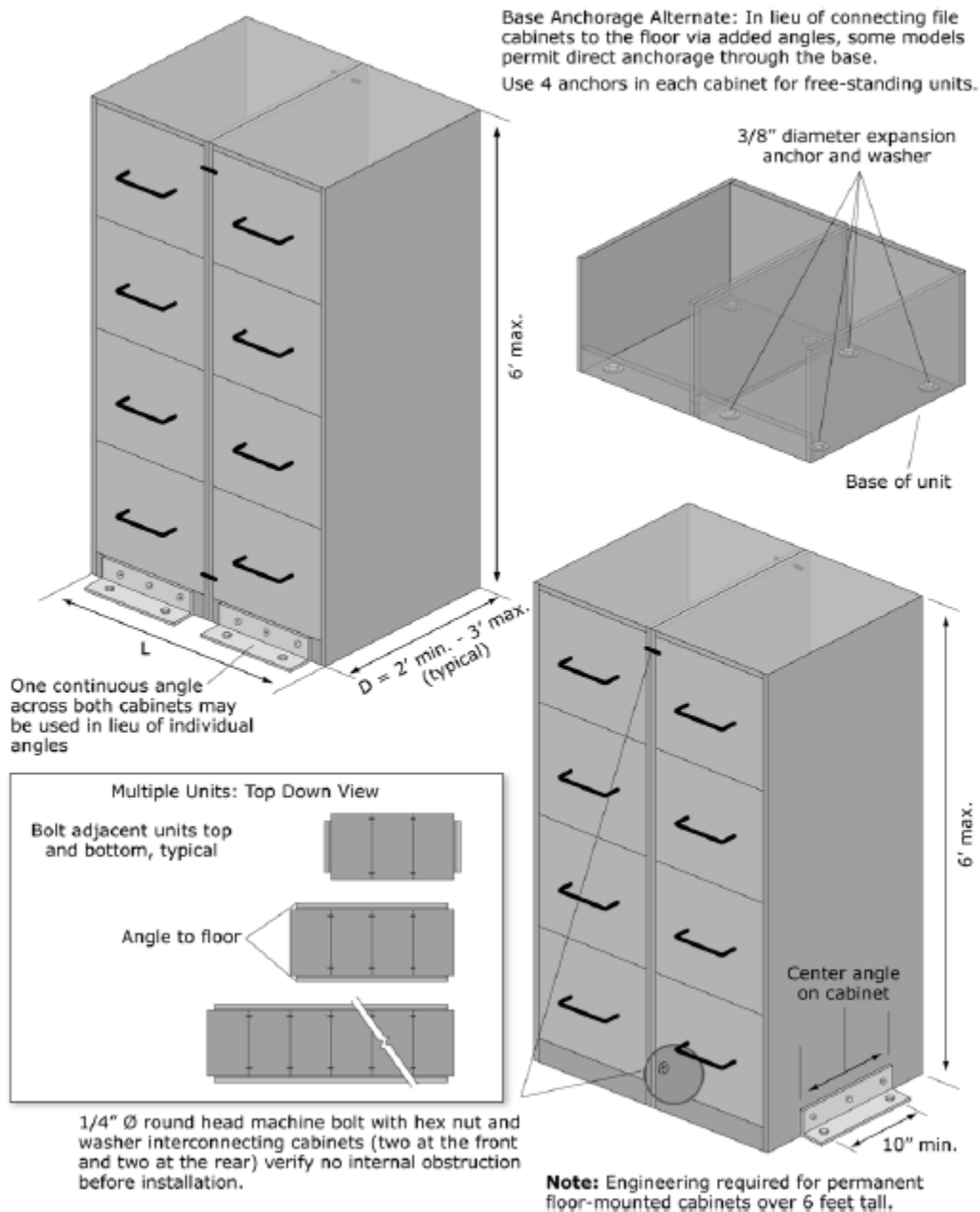


**Note:** Purchase storage racks designed for seismic resistance. Storage racks may be classified as either nonstructural elements or nonbuilding structures depending upon their size and support conditions. Check the applicable code to see which provisions apply.

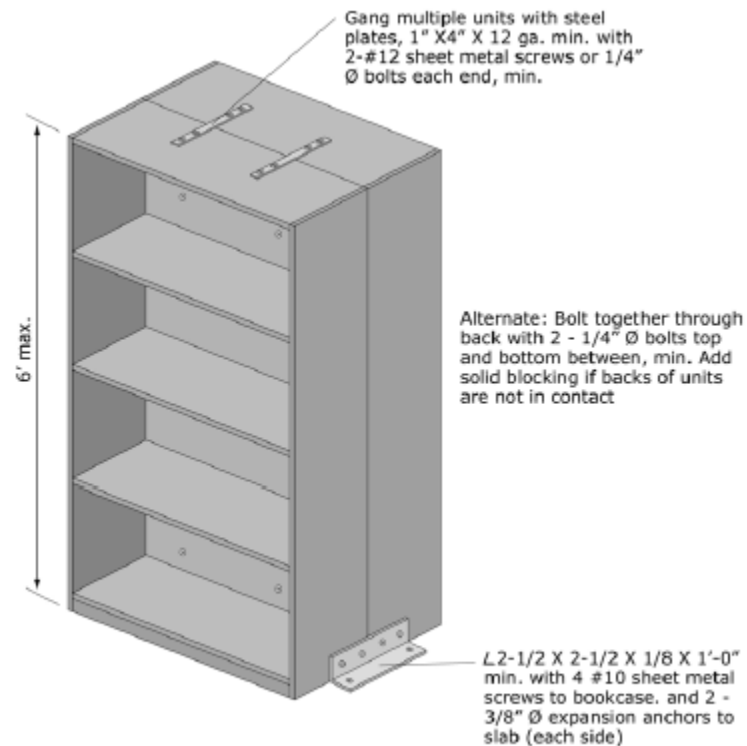
**Figure G-20. Industrial Storage Racks.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



**Figure G-21. Wall-mounted File Cabinets.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

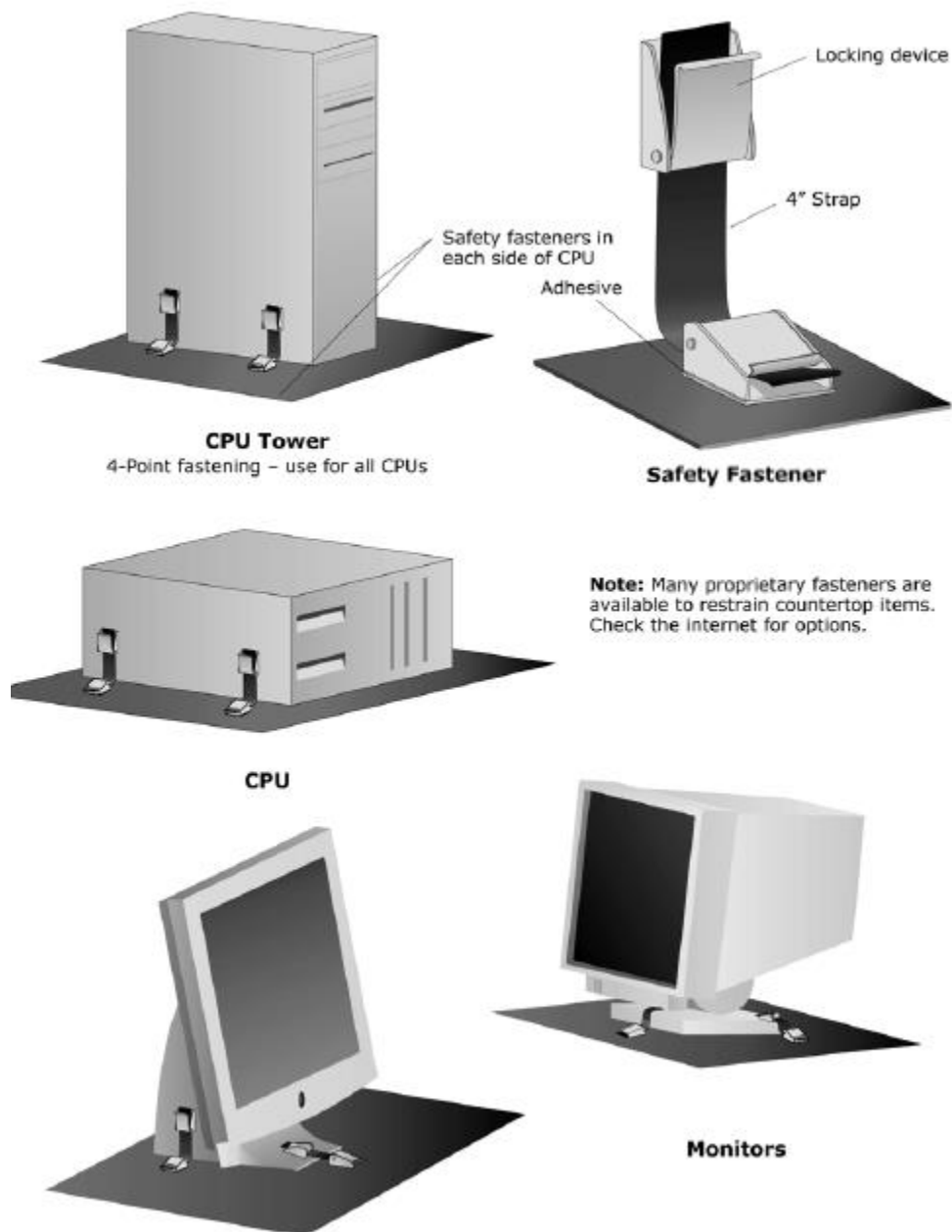


**Figure G-22. Base Anchored File Cabinets.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

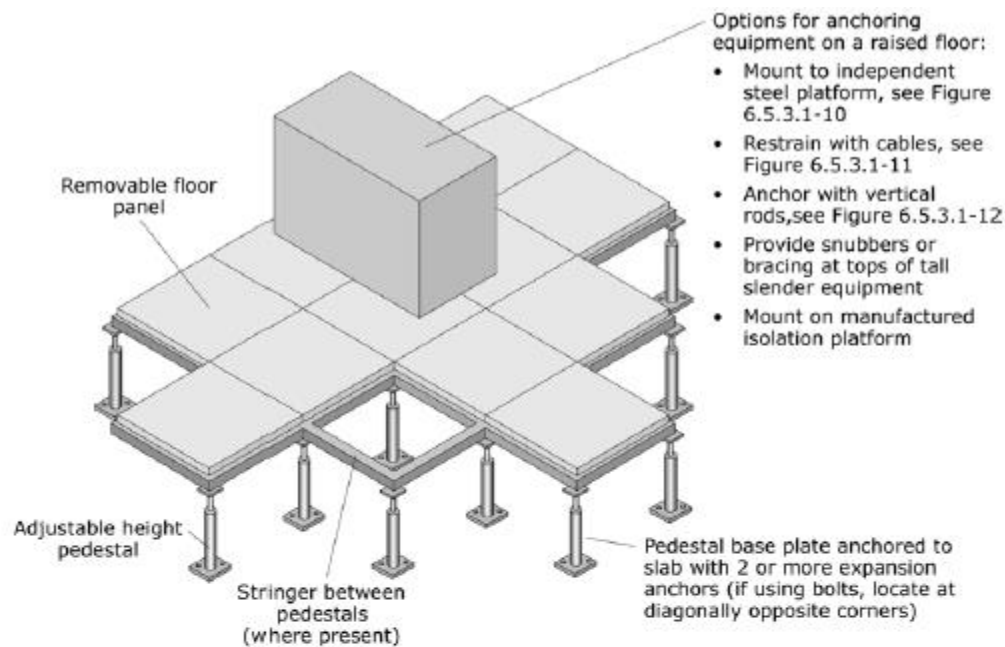


**Note:** Engineering required for all permanent floor-supported cabinets or shelving over 6 feet tall. Details shown are adequate for typical shelving 6 feet or less in height.

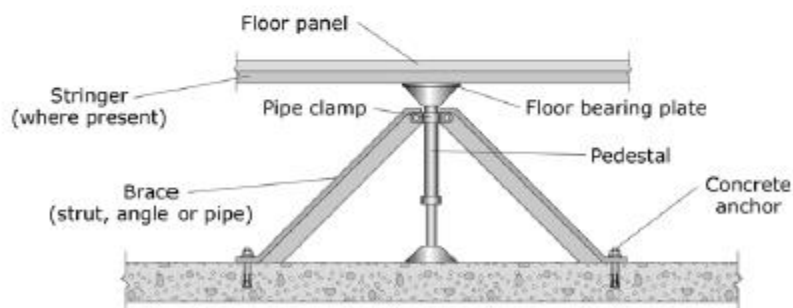
**Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



**Figure G-24. Desktop Computers and Accessories.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



**Cantilevered Access Floor Pedestal**

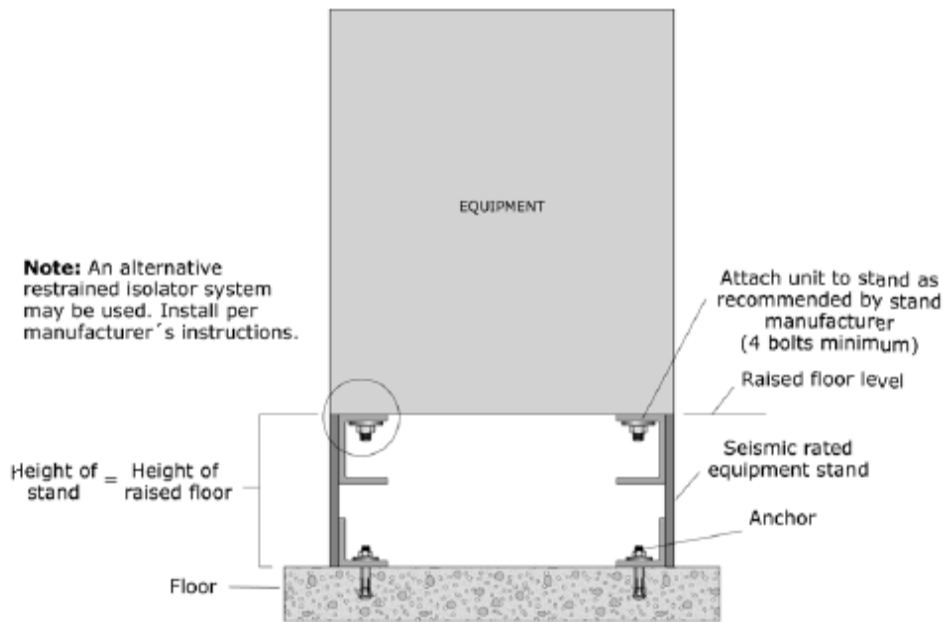


**Braced Access Floor Pedestal**  
(use for tall floors or where pedestals are not strong enough to resist seismic forces)

**Note:** For new floors in areas of high seismicity, purchase and install systems that meet the applicable code provisions for "special access floors."

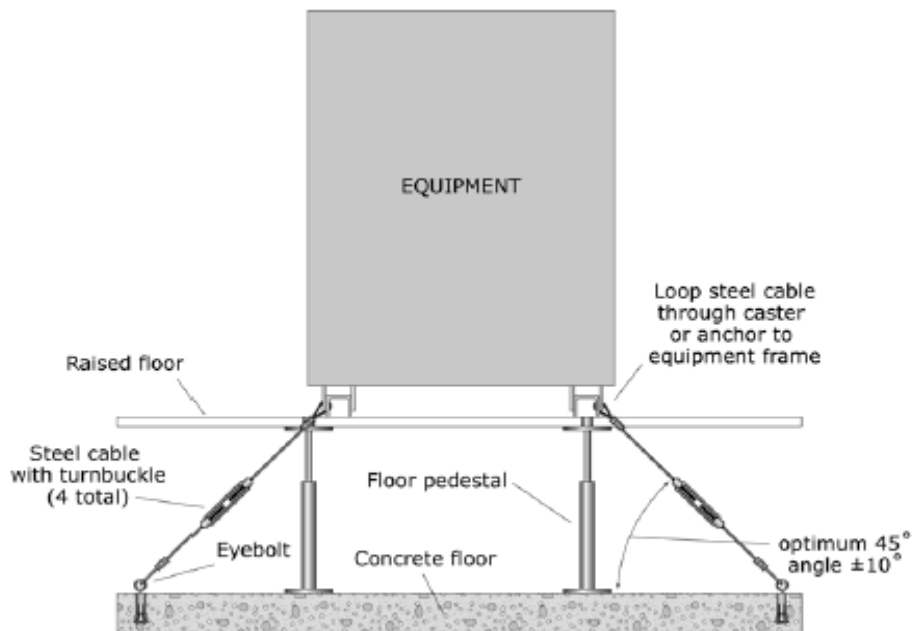
**Figure G-25. Equipment Mounted on Access Floor.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)





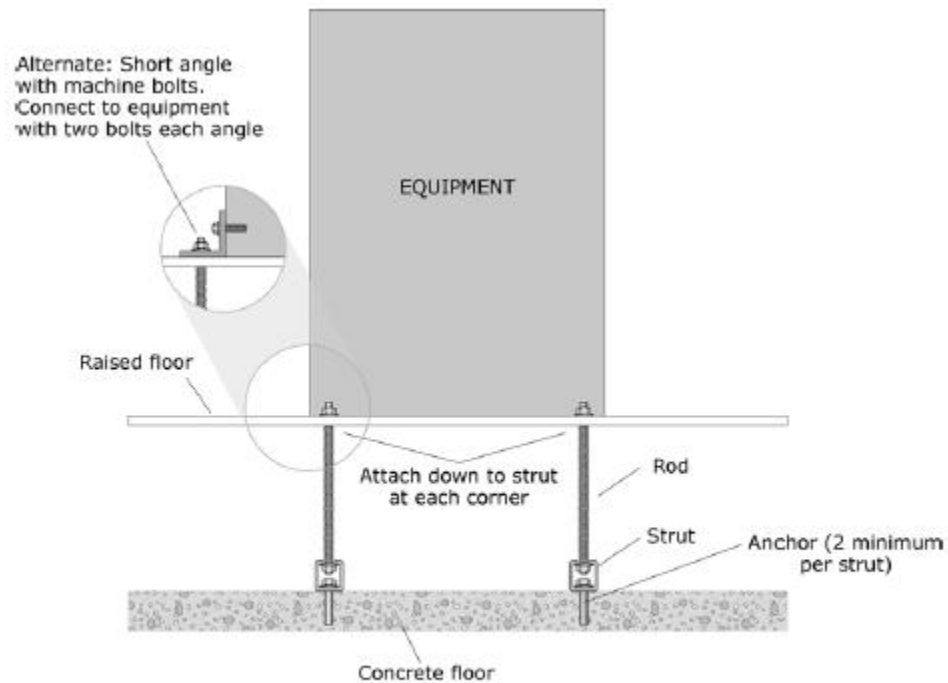
**Equipment installed on an independent steel platform within a raised floor**

**Figure G-26. Equipment Mounted on Access Floor – Independent Base.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



**Equipment restrained with cables beneath a raised floor**

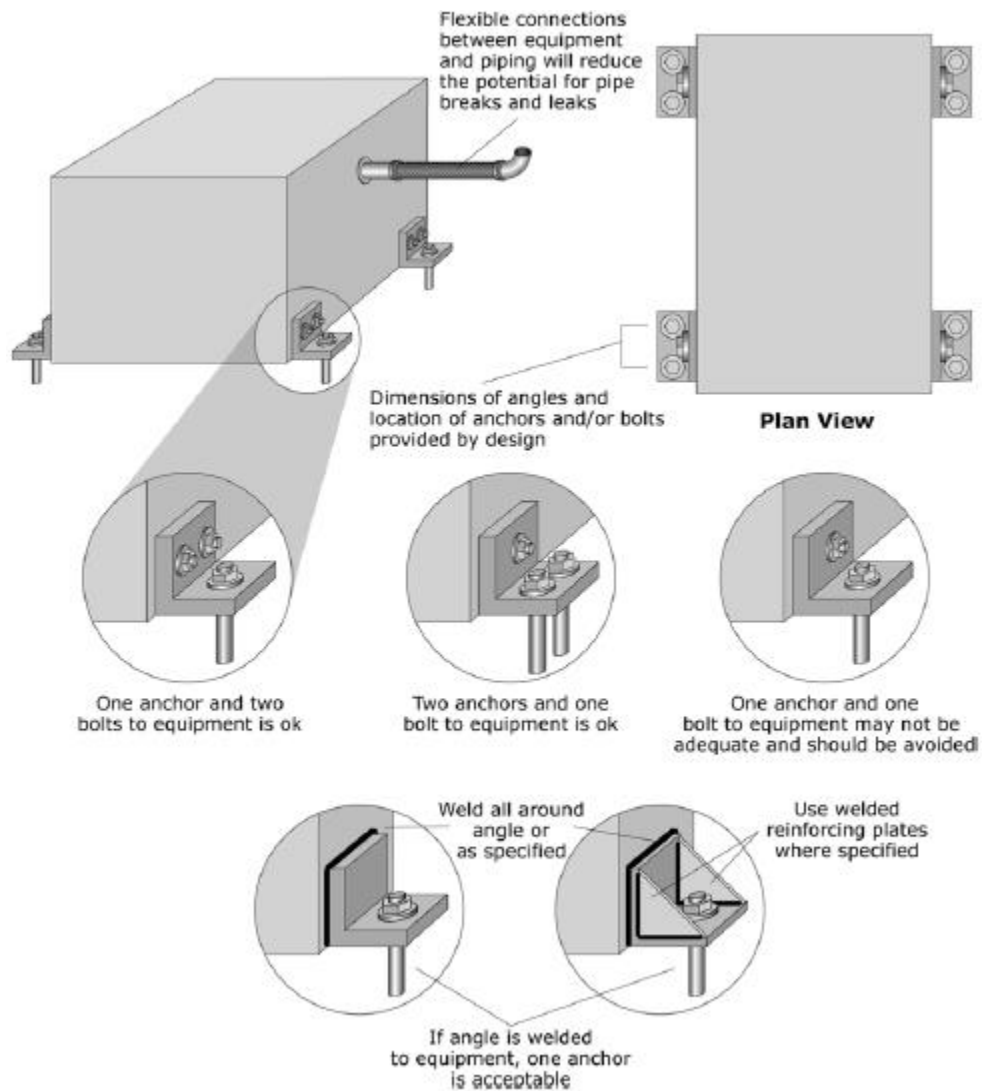
**Figure G-27. Equipment Mounted on Access Floor – Cable Braced.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



**Equipment anchored with vertical rods beneath a raised floor**

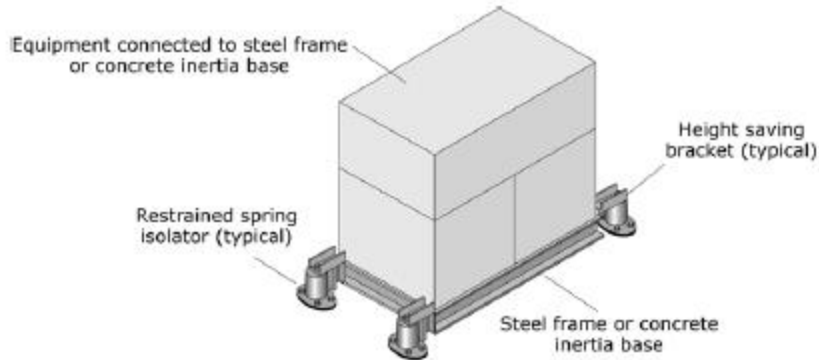
**Figure G-28. Equipment Mounted on Access Floor – Tie-down Rods.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

## Mechanical and Electrical Equipment

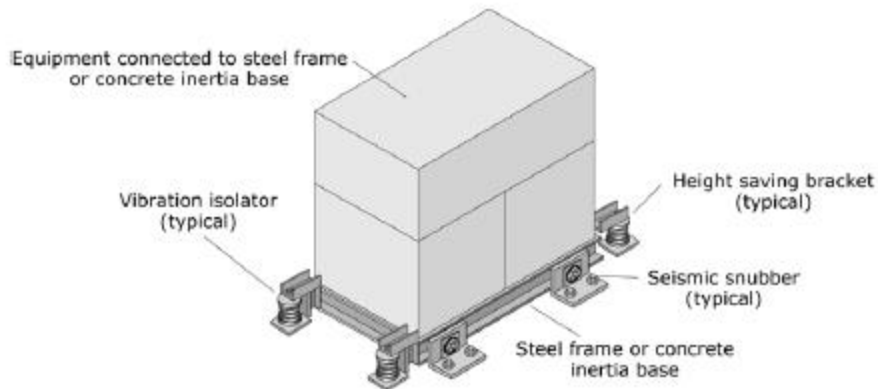


**Note:** Rigidly mounted equipment shall have flexible connections for the fuel lines and piping.

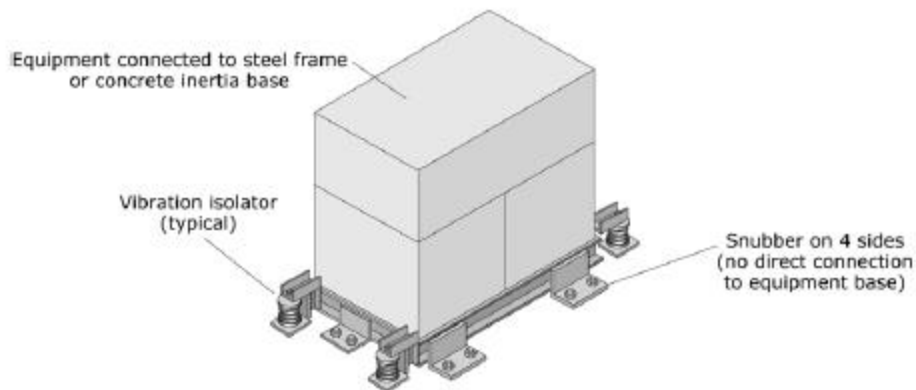
**Figure G-29. Rigidly Floor-mounted Equipment with Added Angles.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



**Supplemental base with restrained spring isolators**

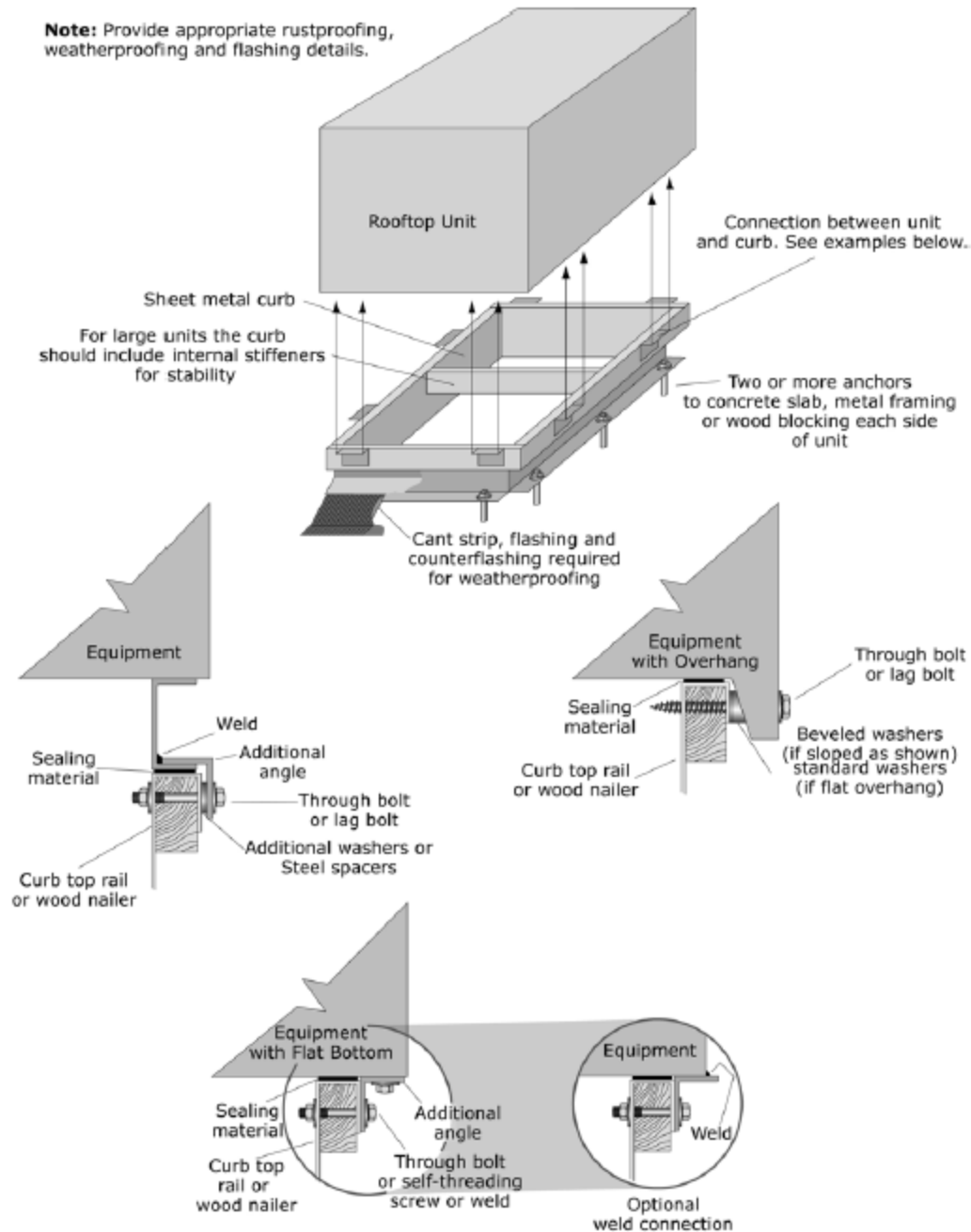


**Supplemental base with open springs and all-directional snubbers**



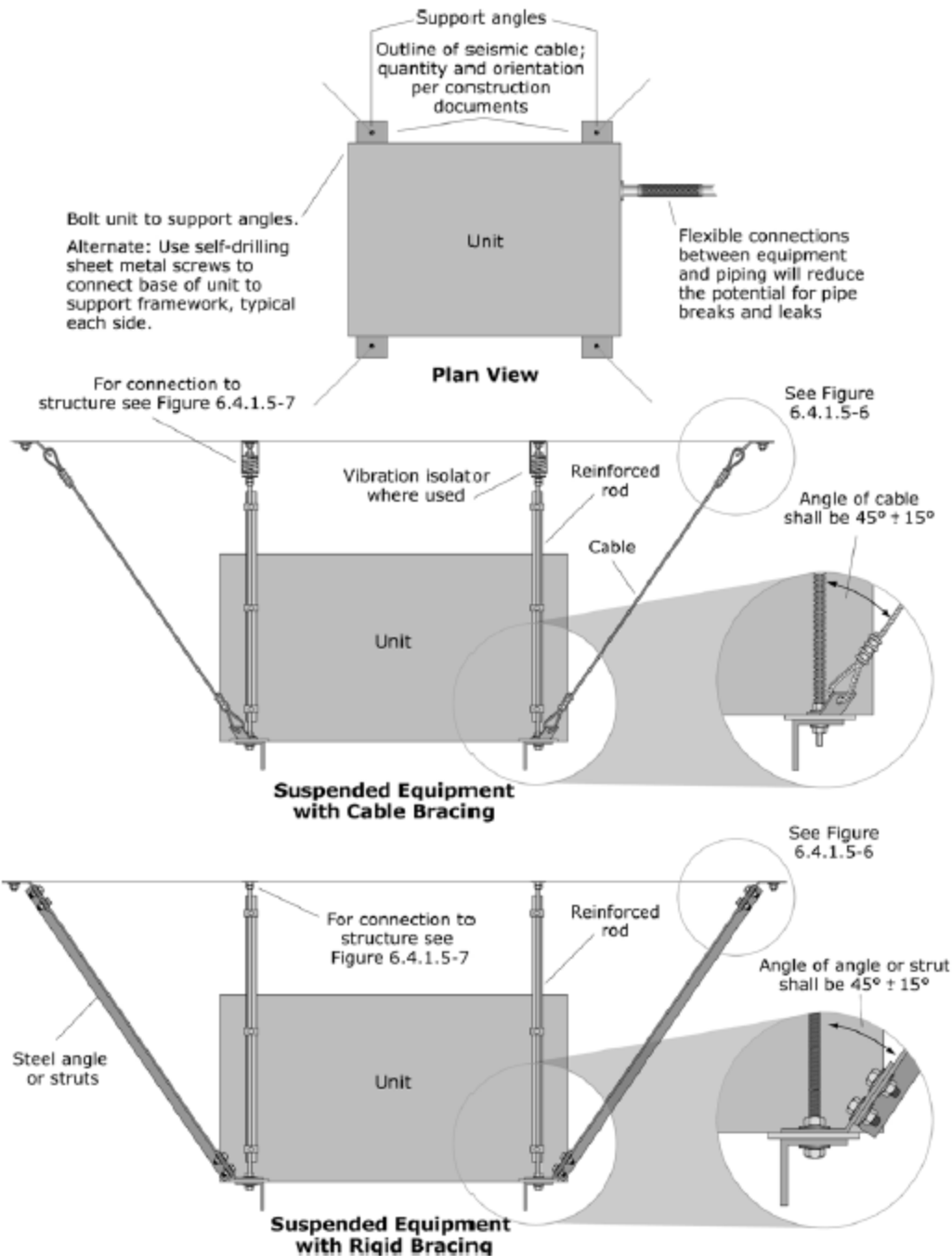
**Supplemental base with open springs and one-directional snubbers**

**Figure G-30. HVAC Equipment with Vibration Isolation.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

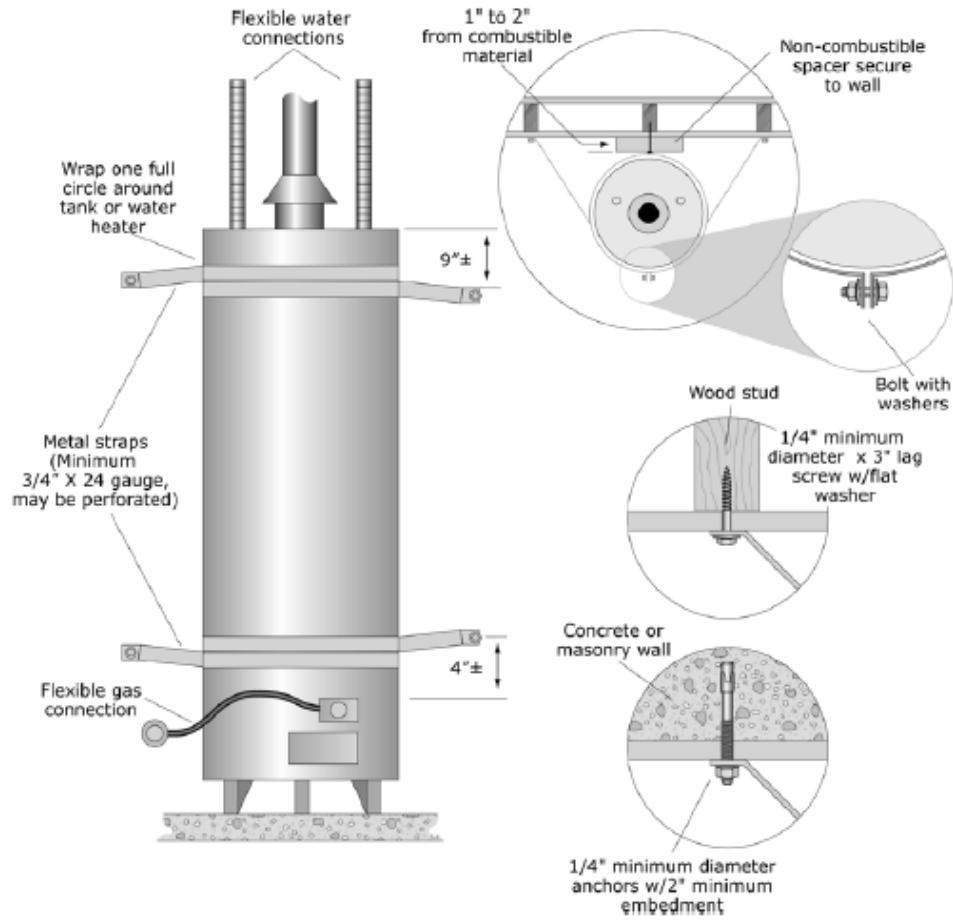


**Figure G-31. Rooftop HVAC Equipment.**

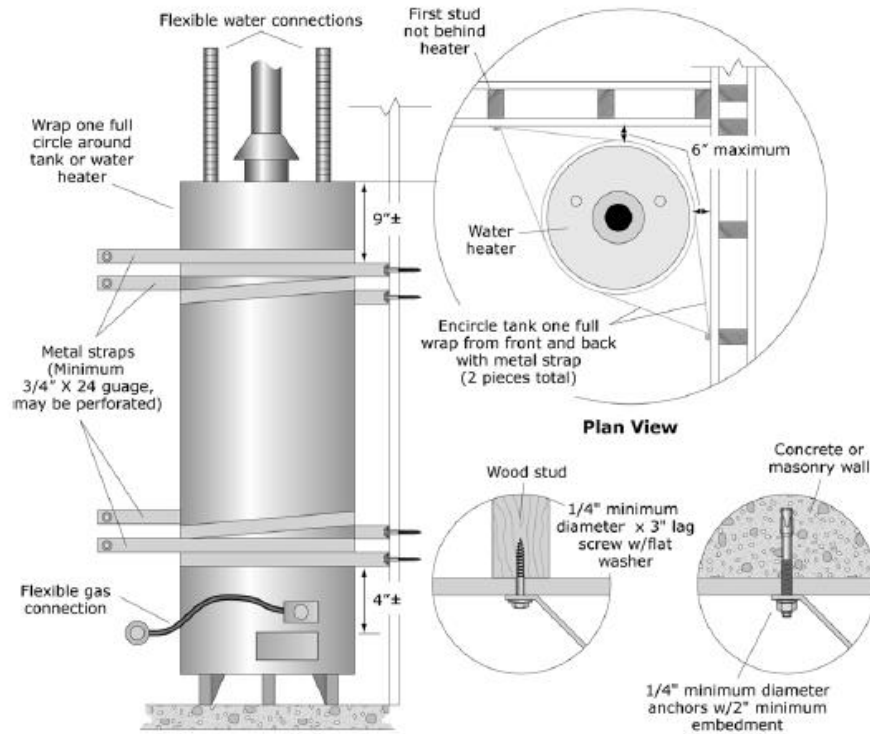
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



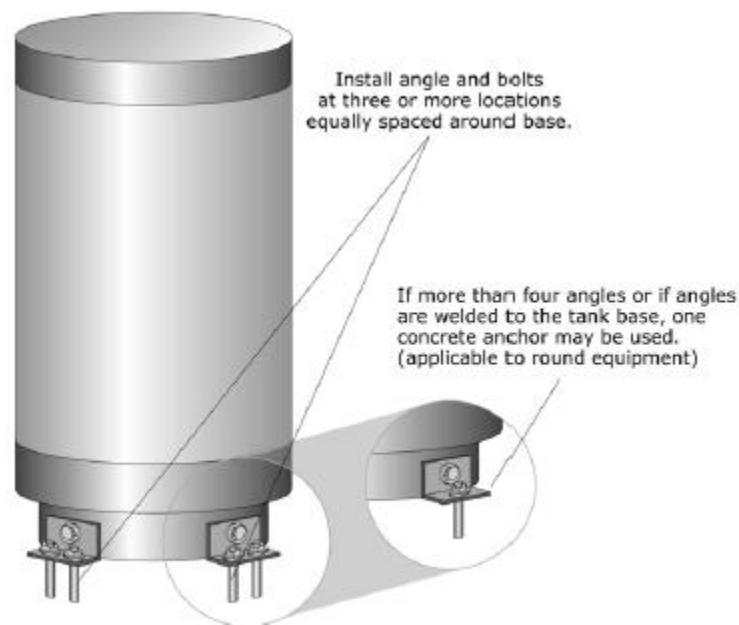
**Figure G-32. Suspended Equipment.**  
 (FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



**Figure G-33. Water Heater Strapping to Backing Wall.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

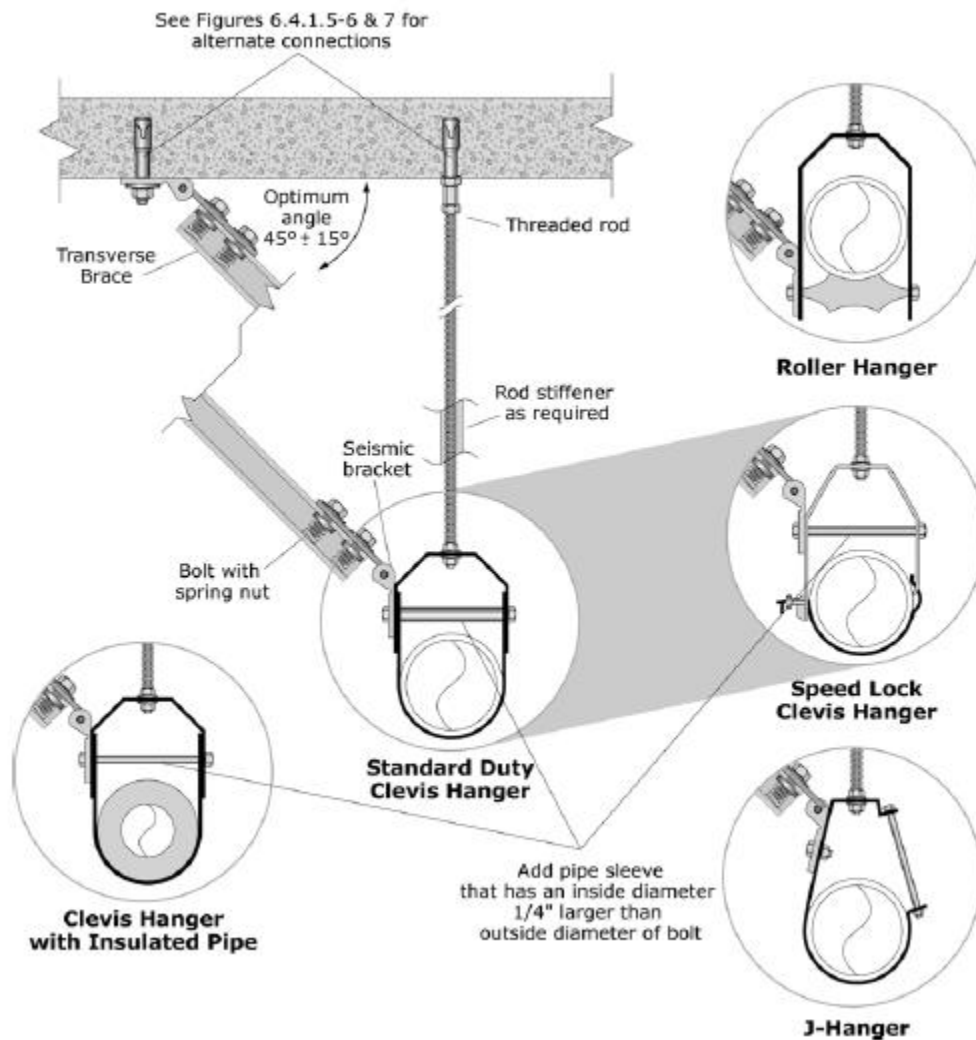


**Figure G-34. Water Heater – Strapping at Corner Installation.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

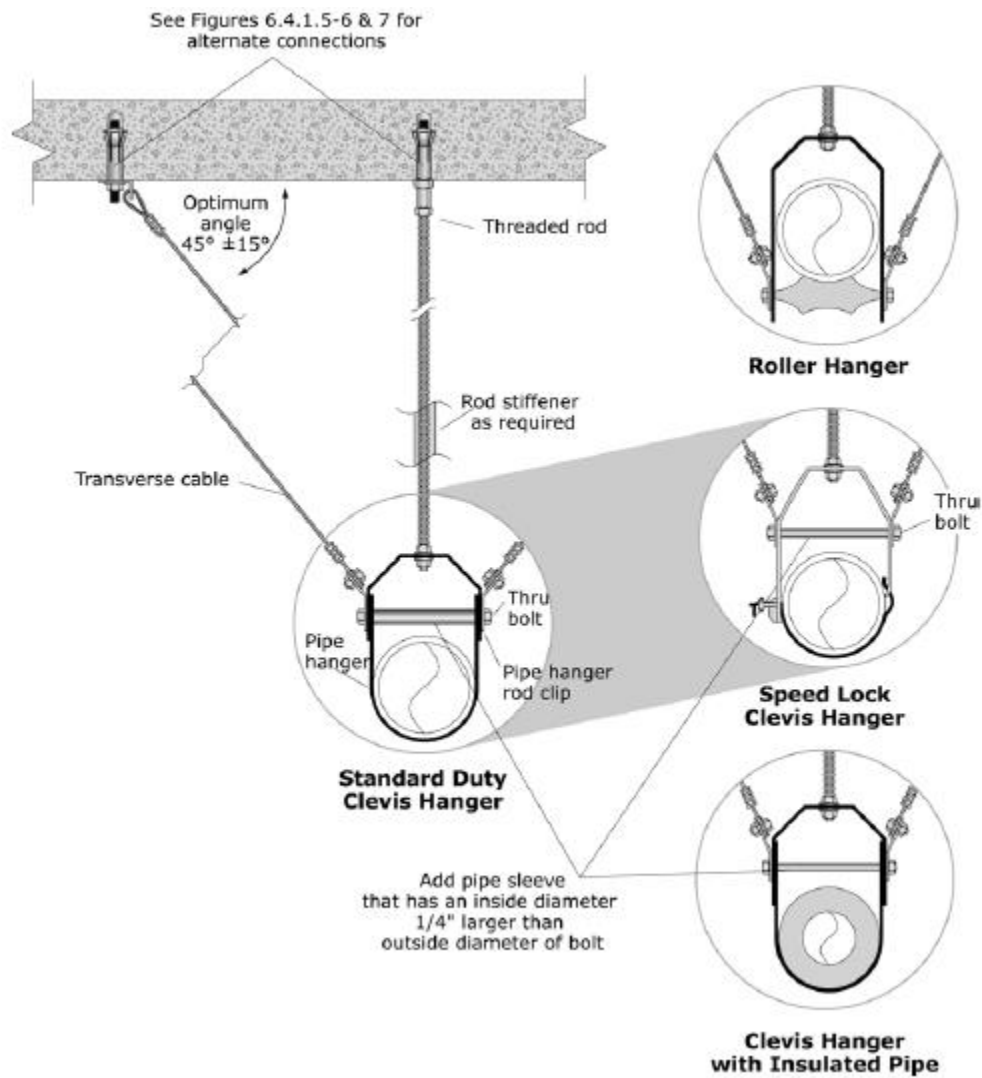


**Figure G-35. Water Heater – Base Mounted.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



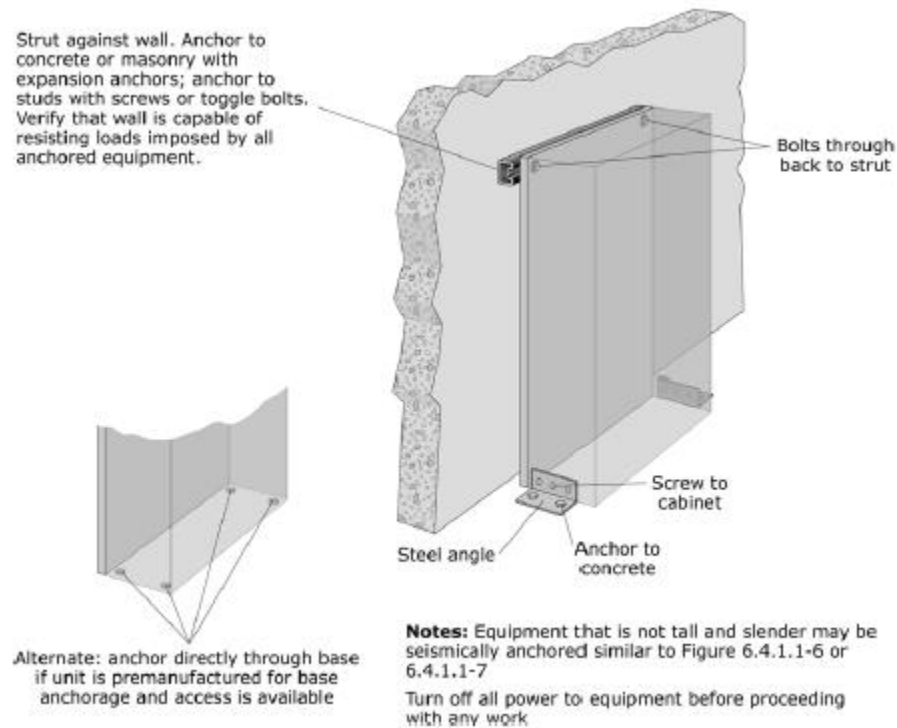


**Figure G-36. Rigid Bracing – Single Pipe Transverse.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

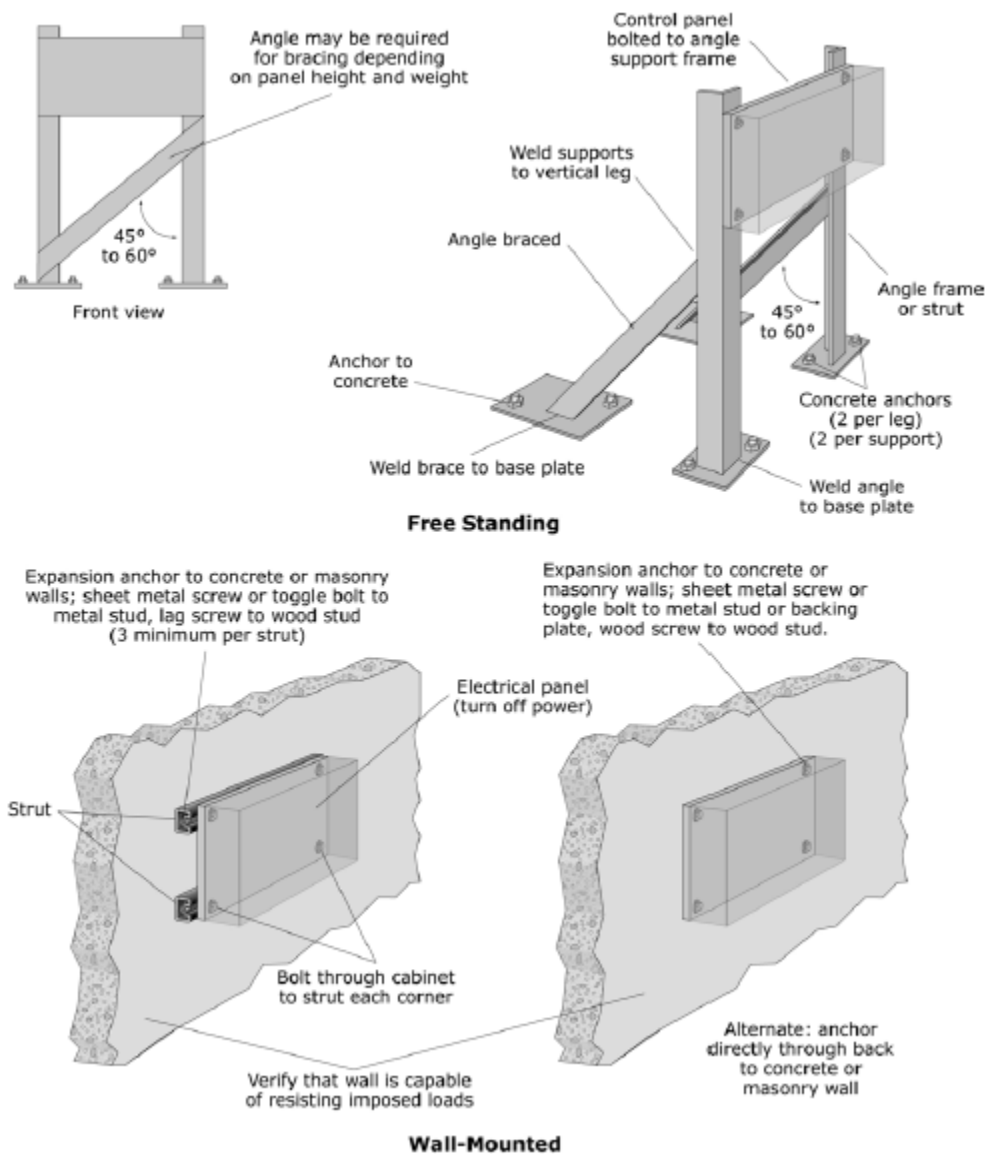


**Figure G-37. Cable Bracing – Single Pipe Transverse.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*

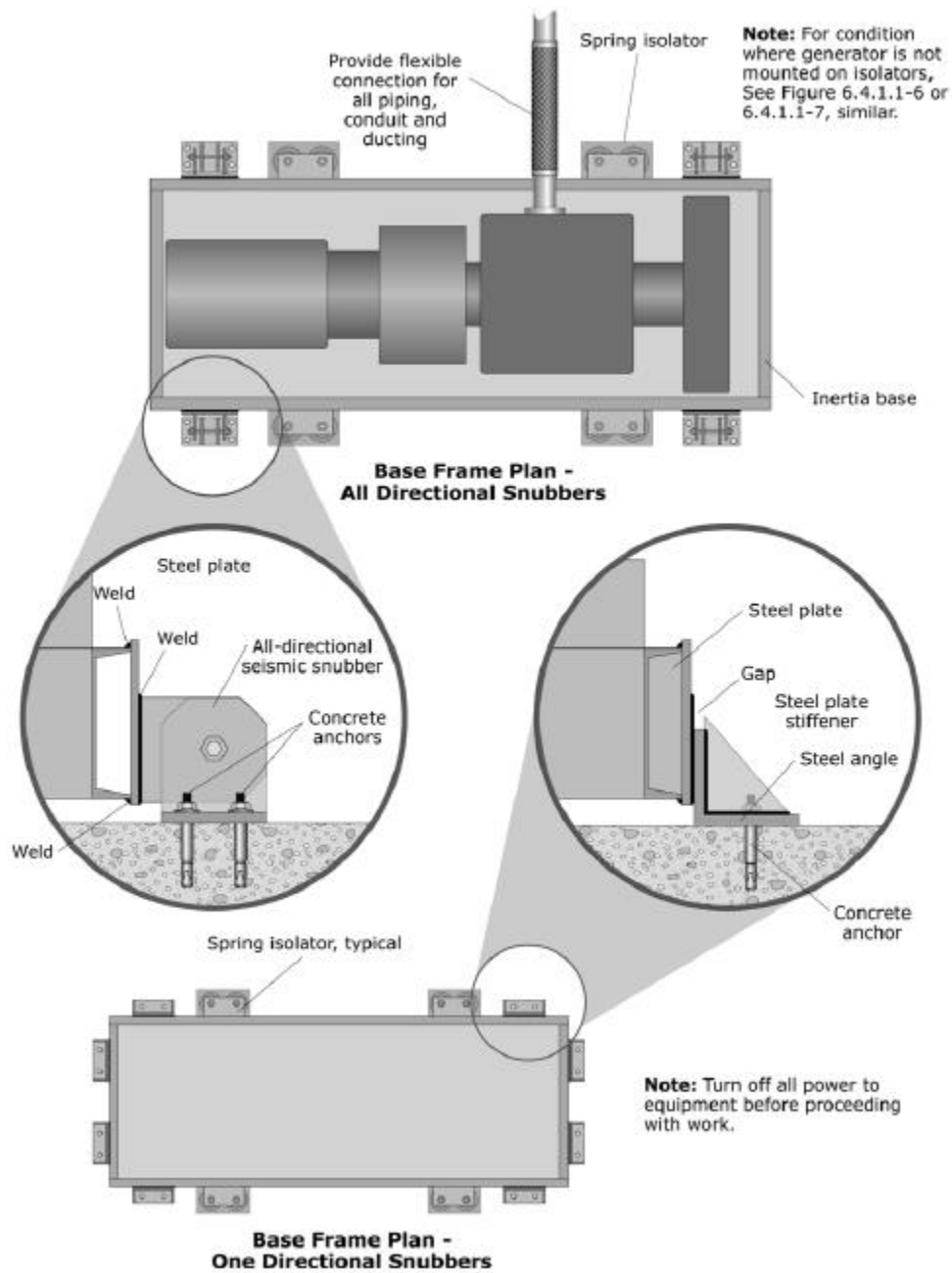
## Electrical and Communications



**Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.**  
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



**Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*



**Figure G-40. Emergency Generator.**  
*(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)*